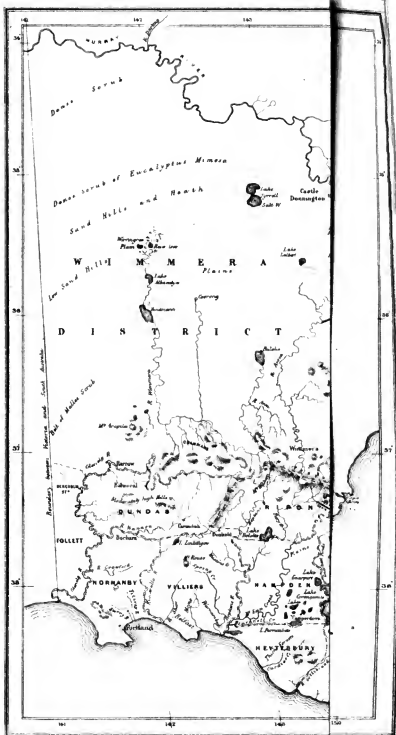


ESSAY

AGRICULTURE OF VICTORIA.

5° 15.1.3



The Victorian Government Prize Essay.

ESSAY

UPON THE

AGRICULTURE OF VICTORIA,

WITH REFERENCE TO

ITS CLIMATE ADVANTAGES, AND THE GEOLOGICAL AND
CHEMICAL CHARACTER OF ITS SOILS ;

THE ROTATION OF CROPS, AND THE SOURCES AND APPLICATION OF MANURES ;
THE ZOOLOGICAL ECONOMY ADAPTED FOR THE AUSTRALIAN COLONIES ;
AND THE INTRODUCTION OF COTTON AND OTHER WARM-CLIMATE PRODUCTS
INTO AN AUSTRALIAN SYSTEM OF HUSBANDRY :

BEING,

WITH SOME ADDITIONS, WHICH ARE PRINTED IN A LESSER TYPE,

THE ESSAY WHICH BORE THE MOTTO

"A G R A R I A N."

ILLUSTRATED BY A PLAN OF A MODEL DOMAIN.

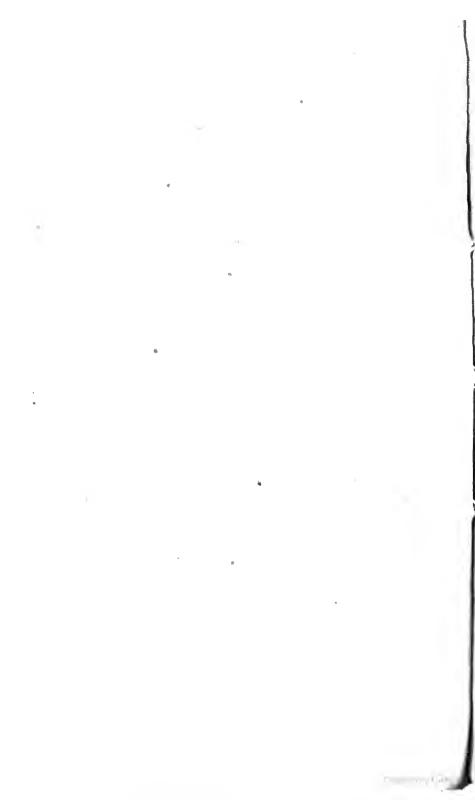
BY WILLIAM STORY.



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CONTENTS.

	PAGE
PREFACE	vii
Preliminary view of the existing culture of Victoria	1
Proposed system of culture in three branches	3
Domain arrangements... ..	7

THE FIRST, OR ARABLE BRANCH OF CULTURE.

Preliminary remarks on the Victorian course of cropping	10
Tabular statement of that course	11
Wheat	13
Potatoes	14
Barley and Rice	14
Clover	16
Wheat	13
Green crops, bulbs and roots, &c.	17
Oats and Rye	18
Pulse, &c., and Maize, &c., followed by catch Clover	19
<u>Systematic catch cropping</u>	<u>19</u>
<u>Variation courses in cropping</u>	<u>21</u>
<u>Repetition mowings and grazings of the cereals</u>	<u>22</u>
<u>Concluding remarks on the arable culture branch</u>	<u>25</u>

THE SECOND, OR GRASS LAND AND LIVE STOCK BRANCH.

Preliminary remarks on the land branch	26
<u>The Anglo-Merino breed of Sheep</u>	<u>27</u>
<u>The Dishley breed</u>	<u>30</u>
<u>The old Lincoln breed... ..</u>	<u>34</u>
<u>The ancient Teeswater breed</u>	<u>35</u>
<u>The Dorset breed</u>	<u>38</u>

	PAGE
The Ryeland breed	39
The Southdown, the Hampshire down, the Shropshire down, the Cotswold, and some other breeds of Sheep	30, 33 35, 37 39
Concluding remarks as to Sheep	40
Neat cattle and dairying	40
The milking variety of shorthorns	41
Some other breeds of cattle	40, 41
The Yak of Thibet	43
Concluding remarks on dairying	44
Horses	44
The Camel family, including Alpacas and Llamas	45
The Kangaroo family	45
The Goat family	46
Swine	47
The lesser fur-clad, and edible and useful animals	47
Poultry	47
Useful insects	48
Pond fish	48
Miscellaneous animal class	48
Perennial pasturage	49
Water meadowing	51
The soiling system of cattle feeding	52

B

THE THIRD, OR VICTORIAN SPECIAL CULTURE BRANCH.

Preliminary remarks	54
Vineyard	55
Orchard and orangery	56
Tea shrubbery	
Coffee plantation	
Sugar plantation	
Hop ground	56
Allotment for Olive grove and other tree and shrub products	59
Allotment for biennial, triennial, and sub-perennial culture, including textile and dye plants, &c.	60
Garden culture	61
Timber trees	61

	PAGE
The acclimating of plants, and the introduction of new varieties ...	64
Dr. Priestley's letter as to the practice of Mr. Cooper, an American farmer ...	65
The Horticultural paper of T. A. Knight, Esq., on new varieties ...	67
Cotton culture ...	73
Concluding remarks on the special culture branch ...	120

AGRICULTURAL SUBJECTS DISCUSSED.

Irrigation ...	121
Agricultural chemistry as applied to manures ...	126
Night soil, sewerage, and homestead manures ...	127
Lime ...	133
Chalk ...	135
Gypsum ...	135
Composts ...	136
Charcoal ...	137
Bone manuring ...	137
Guano ...	140
Salt ...	141
Marl ...	143
Artificial manures ...	144
Application of manures to the cropping of the Victorian course ...	144
Geological and chemical character of soils ...	145
Fencing ...	147
Fallowing ...	149
Draining ...	149
Australian landed economy ...	150
Educational and scientific institutions ...	152
Agricultural literature ...	154
Concluding remarks ...	155

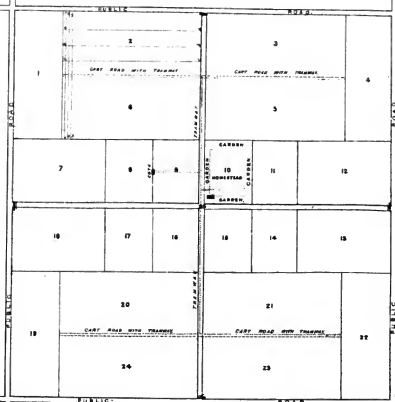
P R E F A C E.

NOTWITHSTANDING my having expanded my Essay into more than thrice its original length, as will be seen by the matter printed in a lesser type, there are some subjects which I consider of great importance, to which I intended to have adverted, but yet left over for after occasion : as, for instance, the preservation of grain, fruit, and other products, for considerable periods, by chemical means, and under systematic storage in vaulted receptacles, with the view of counteracting the baneful effects of market gluts, sustaining uniformity in price, and providing for deficient seasons—subjects on which French savans are praiseworthily bestowing considerable attention—the application of botanical science to annual culture, with the view of economising labor, by transplanting every willing product of importance out of annual into sub-perennial culture, in order to produce prolonged periods of profitable cropping from one seedness, a matter which I think may be turned to profitable account in Australian husbandry, by greatly lessening the demand for labor—the further extension of the appliances of cultural machinery and implements into the province of manual labor, with the view of superseding it in some cases, and much reducing it in many ; and above all,

the application of stupendous machinery-power to surface ploughings, substratum upheavings, and what I will call subsoil leavenings, objects to which the size and shape of Victorian fields invite, and give promise of feasibility, and are, in my opinion, predestined to do for Victorian husbandry what drainage has done for that of Britain. That power may be also applied to water storage excavations and embankments; but, owing to the great cost of such machinery, it will only be under the auspices of local interests, in combination, that its benefits will be reachable by men of ordinary capital. I may here observe, that it will probably be in the large rectangular fields of Victorian domains, which will have the advantage of being free from the obstructions occasioned by the antiquated boundaries and intermingled ownership of old countries, that the vast power of the steam horse will snort into profitable development. A steam ploughing match at either end of an agrarian domain, in which the four arable fields could be taken from east to west, and back from west to east, as an entire field of 156 acres, will be a noble sight, and the consummation response to the aspirations of our British forefathers, in the good old English toast of *speed the plough*.

“AGRARIAN.”

PLAN OF AGRARIA DOMAIN.



Scale 20 chains to an inch.

REFERENCE.

No.	A.	S.	P.	No.	A.	S.	P.
1. West special ground.....	26	0	0	14. Lucern paddock.....	13	0	0
2. Far north-west field.....	29	0	0	15. Home paddock	13	0	0
3. Far north-east field.....	29	0	0	16. East sheep pasture	13	0	0
4. East special ground.....	26	0	0	17. West sheep pasture	13	0	0
5. Near north-east field	29	0	0	18. South cow pasture	26	0	0
6. Near north-west field	29	0	0	19. Water meadow.....	26	0	0
7. North cow pasture	26	0	0	20. Near south-west field	29	0	0
8. Cote paddock.....	13	0	0	21. Near south-east field	29	0	0
9. Hospital crofts	13	0	0	22. South special ground	26	0	0
10. Homestead	13	0	0	23. Far south-east field	29	0	0
11. Clover paddock	13	0	0	24. Far south-west field.....	29	0	0
12. Vineyard.....	26	0	0	25. Inner or private roads	16	0	0
13. Orchard	26	0	0				
					640	0	0

E S S A Y.

THE agricultural statistics of the colony of Victoria, as given in the recent report on its resources, show, that of the three millions of acres, which in 1859 had passed into private ownership, less than three hundred thousand acres had been brought into cultivation, which was thus cropped:—

	Acres.
Wheat	78,234
Oats	77,526½
Barley	5,322
Rye 57½, Maize 480, Beans, Peas, and Millet 264½	802½
Potatoes	30,026½
Turnips 332, Mangel-wurzel 185½, Red Beet 3½,	
Carrots and Parsnips 96½, Cabbages 75 ...	692½
Hay of the Cereals Wheat, Oats, and Barley ...	85,606½
Hay of Rye Grass and Clover,	556
Green Forage of the Cereals Wheat, Oats, and	
Barley,	3,779½
Green Forage of Maize 315½, Lucern 283, Clo-	
ver and Vetches 328, Sorghum 600½ ...	1,027
Permanent Artificial Grasses	2,602½
Gardens 5486½, Orchards 397½, Vineyards 547½,	
Tobacco 66½, Onions and other crops 288½	6,786
Land in fallow preparation for cultivation ...	5,998½
	298,959½

Wheat and potatoes, and also the cereals (as hay and green forage), appear to have taken up proportionate areas in accordance with my preconceived notion of a fair course of colonial cropping; but the other crops are all in random quantities, the permanent artificial grasses being surprisingly low in quantity, but oats being greatly in excess of any sustainable course of cropping. As the bulk of the cereal hay, and much of the cereal forage was proba-

bly eaten, it may be assumed that half the cultivated land of the colony was in oats; which are known to be the most impoverishing crop of the cereals.

As this result as to oats indicates a partiality for that crop, which, if not checked, may become a vulnerable point in Victorian husbandry, I shall, in the way of monition, state the prejudicial effect which over-eating had on an English arable parish, which in olden time had been proverbial for the growth of its wheat and oats.

That parish, in the days of Jethro Tull, had adopted his triennial course of fallow, wheat, and oats in perpetual succession, and had clung to it a century, when I became connected with its agency management. My connection lasted thirty years, and save upon some land which had remained a pasturage common for sixty years, after the adoption of the course, and had therefore been but little under it, I never saw a crop of oats which repaid the grower, though the wheat crops continued good, and fully sustained the wheat-growing reputation of the parish. On consulting old men as to the cause of the oat failure, I found, that after a dozen rounds of the new course, everybody's oats had failed, and the parish had never yielded more than half crops since, but they all admitted that wheat had never failed. I attach more than ordinary importance to the experience of this parish, because owing to there being coal and lime works in its neighborhood horse labor had been all the while in great demand, and as a consequence, many oat-fed horses had returned, in their contribution to its farmyard manure much of the oat ingredient, though but little of the wheat ingredient had been returned, because the parish was thinly populated, and nearly all its wheat was consumed in the mining districts; moreover, the comparative goodness of the oat crops on the newly broken up land, evidenced that the ancient oat growing repnte of the parish was well grounded, and my inference was that oats, continuously grown in quick succession, do affect land prejudicially, and that excessive oat growing is bad husbandry, and is as such to be denounced.

The more recently published statistics for the year ending the 31st March, 1860, show that the quantity of land then in cultivation, had augmented to 357,764½ acres, of which, almost a third of the whole, viz., 107,078½ were in wheat, and 5556½ acres in permanent artificial grasses; both of them very satisfactory

results. Another source of satisfaction is that, at a recent agricultural show, Victorian wheat beat in fair competition the wheat of South Australia, which by its admitted merit, at the great English Exhibition of 1851, had won for that colony the leadership in Australian agriculture. I was also gratified on averaging the yield of the last year's wheat, to find that it reached $21\frac{1}{2}$ bushels to the acre throughout the colony; which, considering the primitive husbandry yet practised, contrasted favorably with the general average of England.

This preliminary view of the existing state of Victorian culture, appeared to me properly to preface an Essay, intended to suggest a system of husbandry, adapted not only for Australia Felix (as the colony was at first aptly named), but also for first-class land of any other Australian colony, which may choose to adopt it.

The importance of the colony of Victoria, which nearly equals in area the entire island of Britain; the excellency of its climate, and its soil; the conveniency of its position, and of its division by the mountain ranges which bisect it; the uniformity in shape of the Land Act sections, and the dignified size of the embryo domains which will result from its maximum grants, under the recently passed Land Act; the enlightened era in which the agriculture of the colony has to be developed, and the commercial and filial connection which subsists between "garden cultured England" and the colony; the vicinage of Victoria to China, Japan, India, and the Australasian islands, which have long been the monopolizers of special products, and the friendly and commercial relations of the colony with every country of the earth which has animals and plants, worthy of Australian reception and attention, to offer in exchange for our Kangaroos and Orange-trees; and the probability that the mutual wants of the gold miner and of the agriculturist, will lead to the effective co-operation of the two interests, and result in the establishment of an extensive system of water conservation and supply, for systematic irrigation; all concur in demanding that the agriculture of the colony, (which has the advantage of a *de novo* beginning,) shall, from the first, assume dignified position as an inductive science, and be relieved from the necessity of having to squat as a mere routine plough-tail craft, unworthy of exaltation, when necessity for the primitive husbandry of pioneer settlement shall have passed away.

The Alpine ranges, to which I have before alluded, and which so conveniently divide the colony into approximate moities, point clearly to the inference that the sub-tropical products of cane-sugar, coffee, spices, cotton, indigo, pepper, &c., and the super-varieties of rice and other products requiring a given degree of heat will have better development in North Victoria than in the southern moiety of the colony; and that the cereals and Anglo-Australian products will have better development in South Victoria than in the northern moiety of the colony. This important feature in the geography of the colony is probably predestined to give a distinctive character to the agriculture of each locality, and an Austral-Oriental feature to the moiety having its watershed towards the River Murray.

It is obvious from the quoted statistics, that though individuals have made praiseworthy beginnings, the agriculture of Victoria is yet inceptive, and has no pretension to system. Being anxious that the recently passed Land Act and Victorian agriculture shall start well together, I have bestowed some thought upon the division and arrangement which will best adapt the Land Act grants for the mixed system of husbandry which it will be my aim in this essay to propound; and in producing an arrangement under which the cultivators of maximum grants, and of minimums, and of intermediates, may pursue similar husbandry, and co-operate, if so minded, in the establishment of a system sufficiently universal to be appealed to as the standard practice of Australia.

To be well based, Victorian agriculture should be grounded on English husbandry, so far as Anglo-Australian cropping and objects are relevant; and on the best warm-climate culture of other countries as to cropping and objects hitherto foreign to English culture, but which the genial climate and the fine soil of Victoria predispose it to produce.

As the English term "farm" does not do justice to the tenure of a Victorian grantee, who, by being luckily the owner as well as cultivator of his grant, is not in the true sense of the word a "farmer;" I shall reject these terms as misnomers in Victoria and substitute in their stead those of "domain" and "agriculturist;" not that I have any dislike to the word farm, which is dear to me by association, and because it exemplifies in the sterling dignity which has attached on British farmers, as a class,

the effect of free institutions in elevating both character and calling; for be it observed that neither the word farmer nor the calling which it was intended to designate had aught dignified about them, when the word "farm" was jostled out of a Norman-French vocabulary into the English language, and as both the calling and its fraternity are yet without dignity on the French side of the Channel, the inference, that the dignity is altogether of British origin, is in my opinion justifiable.

Mixed husbandry is certainly the best for the community, and the safest for the husbandman, because it rarely happens that the "plough and the pail," or the "fleece and the vineyard," are despondingly bad at the same time. The Flemings have a proverb, that "without forage no cattle; without cattle no manure; and without manure no crops;" and there are many recorded instances in which in trying times the profits of one department of an establishment have met the losses of another. The fruit of experience is always worth gathering, and I am inclined to think, that notwithstanding the amazing development which sheep-farming and the patriarchal pastoral system have received since they became Australian, the colony may experience famine or become poverty bestricken in the midst of resources if one department of rural economy shall be allowed to keep under the due development of another. Time has been when Australian flocks and herds were valueless, and ruin was the consequence, because the colonists had no "wine and oil," or "butter and cheese," or "grain and tillage produce," to fall back upon to meet pressing payments in some cases of no great magnitude, probably in many, for produce which their own land would have produced, even of better quality than that in respect of which their overdue bills (then working ruinously) were given; and similar times as to panic may recur again, but not I trust with ruinous results.

In a vista of the future, near enough for mental ken, I saw the germ of Australian agriculture (a Victorian seedling) vegetate, and watched it till it reached a sapling's growth, and bud for branching into triune form. The first shoot bore affinity to British arable culture, but was amplified by the admission of rice, sugar-beet, maize, and such other warm climate productions as fall in with an annual routine of field culture. The second shoot bore affinity to British grass-land, and stock and dairy husbandry,

as expanded by European soiling management, and Australian shepherding; but it embraced in its scope greater animal variety than had been attempted in the pre-existent range of domestication of any one of the four older divisions of the earth. In the third and aspiring shoot I saw so little affinity to British antecedents that I named it the Victorian special culture branch, believing it predestined to give a fruitful and Norfolk pine-like crowning to the goodly tree.

I shall now abandon metaphor and resume my leading aim, which is, to instance in the division and proposed arrangement and management of a well-selected South Victorian maximum Land Act grant of 640 acres, which (in allusion to an agrarian-like feature in the Act under which I assume its ownership to have been acquired) I shall call "Agraria Domain," the proportionate development of each of the three branches of Australian agriculture, with the view of exhibiting their goodly proportions, and of showing into what a dignified and profitable possession, capital, skill, and industry, aided by practical science and the climate of Australia, can transform such a maximum grant.

The square-like shape of a Victorian section facilitates not only convenient subdivision but uniformity with simplicity in arrangement also. Much of the perfection to which Victorian agriculture will doubtless in the sequel arrive will probably, with propriety, be attributed to the method and regularity in conducting operations which judicious domain arrangements will induce. In that of "Agraria" I have aimed at giving areas to each of my three departments which will ensure proportionate development, and at placing the land of each in a convenient position to be managed harmoniously as a whole.

The accompanying plan and reference illustrate the subject; and I may state that by proportionate reduction or enlargement the arrangement will adapt itself to any square area, however large or however small.

On revising for the press in June, 1861, I avail myself of the opportunity to add that I hold it to be the duty of a colony, and especially of such a favored one as Victoria, which is in fact blest with three climates, viz., the temperate one of Southern Victoria, which contrasts favorably with that of Tasmania; the sub-tropical one of Northern Victoria, which contrasts favorably with that of Queensland; and the intermediate one of Gippsland, which combines the advantages of both; to be as self-supporting

as its soil and these climate advantages will permit, and to aim also at being as independent as it can of other communities, not only for its food and clothing, but also for such articles of luxury as have come to be regarded as essentials in common notions of enjoyment—as for instance, tobacco and stimulants, in which parties having the means will indulge, whether the precepts of morality pronounce that indulgence right or wrong; and holding this view, and being persuaded that it is practicable to combine with the culture of the cereals not only the soiling system of Europe, but the production also of such of the textiles and the dye plants as are strictly annuals, and peradventure to some extent, the production of cotton also, in one harmonious annual course, I shall take a wide vegetable range in quest of the objects of that course, and thereby make it a vehicle for introducing Victorian agriculturists to the knowledge of the wide range in cropping which awaits their selection.

It is well known that land delights in change of crop, and that it exerts greater energy in the production of what is new to it than it does in producing repetition crops of kind after kind, however congenial to the land that cropping may be; and such being the case, I shall endeavor so to humor the land under my course, by a regulated succession of changes, that it may be kept up to its highest point of willing yield. It will be my endeavor also, to establish such a rotation as will conduct the operations of a domain with regularity through a longer period than is yet common in rotations; and to indicate the place among kindred or congenial cropping which may be properly taken by posterior introductions into Australian husbandry, without deranging the cycle of the course; my anxiety being that no special culture enclosure shall be unnecessarily crowded by any crop, which can be made to submit to a strictly annual routine, because I have a presentiment that biennial, triennial, and sub-perennial culture will, ere long, ramify to an extent greatly beyond present anticipation, and that the special ground (numbered 22) which I shall set apart for that culture, will always have many urgent demands on its space. It will be my aim also, to subject double or catch cropping, and what I shall designate cereal-pasture, cereal-fodder, and cereal-soiling, yield to pre-arrangement, with a view to proximate certainty in crop calculation.

My domain arrangement assigns 312 acres to the first, or arable department, being, with a moiety of the private road, exactly half the domain. This 312 acres is divided into eight rectangular fields, of 39 acres each, numbered 2, 3, 5, 6, 20, 21, 23, and 24 on the plan, being an arrangement purposely for an eight years' course of cropping. It assigns 169 acres, being numbers 7, 8, 9, 11, 14, 15, 16, 17, 18, and 19, to permanent grass and herbage land, in aid of the fodder and cattle food contributions of the eight arable fields, which, under soiling management, will be the main source of supply for the second or

stock and dairy department, and which I have placed purposely near the homestead, to keep stock, when in pasture, in constant view, and so as to be soon seen and reached in the event of disaster; and it assigns 159 acres, being numbers 1, 4, 10, 12, 13, 22, and 25, to the third, or special culture department.

I have to premise that requirements of greater depth of soil for some purposes than for others, and especial desirability of aspect, and also water supply, may suggest deviations as to some of the foregoing numbers, which may lead to transpositions; but such deviations may be made without deranging the proportionate areas assigned to each department, as, for instance, it may be found that a change of sides between the orchard and the vineyard may be to mutual advantage, or both may change places for the better with the cow pastures, or with some of the special culture allotments, and if so, such transpositions ought to be made. Spot adjustment will probably assign the lowest corner of the domain as the place of the water meadow, in order that (on the catchwater principle) it may receive the last benefit of the water before it leaves the domain.

The less fencing, and the fewer the divisions, so that arrangement is well effected, the better; and I apprehend that the best way to "speed the plough" will be to lessen the number of its turnings when it is in operation. I have, therefore, given to the arable fields a convenient length, in order that when the difficulties which have hitherto beset steam ploughing and mowing, and some other operations, shall have been overcome, steam power shall not be fumed uselessly away in a multiplicity of short turnings. By ploughing lengthwise of the field, and working other operations crosswise, more effectual tillage will ensue than would be the case if all the operations were performed in either direction.

As an effect of the precision in arrangement, derivable from the square shape of a section, I may instance that by simply planting thirty-eight lofty trees, of distinctive character, at equal distances from each other, and from the end fences, along both sides of each of the four quarters of the arable land (as I have instanced in the fields numbered 2 and 6, as to the trees 1, 2, and 3 of their series), a system of tree marking, or ground ready reckoning, may be provided to adjust and perpetuate the bounds of any acre, or combination of acres, to regulate not only sub-division in

cropping, but also to reckon task work in reaping, &c., &c., &c., by mere sight observation from a tree to its fellow tree in the opposite fence, and counting trees between point and point. By distinctive and contrastive character in trees, I mean that both numbers 1, for instance, may be cedars, both numbers 2, cork oaks, and both numbers 3, larches, and so on; an arrangement which will enable the eye to recognize a fellow tree instantaneously by its outline, and so facilitate the turning up of a division furrow wherever it may be wanted. Ten sorts of trees will suffice as markers, for numbers 11, 21, and 31 may each be the beginner of a repetition series. I may observe that by planting three Lombardy poplars, or any three distinctive lofty trees along the end fences of the arable fields (as I have also instanced by the letters *a*, *b*, *c*, in the before-mentioned field No. 2), at equal distances from the side fences, and from each other, they will serve as fixed points, from which sight observations can be taken for dividing an acre into halves and quarters when small quantities may be wanted for experimental or other purpose. A similar arrangement may be carried into the allotments of the special culture department. If preferred, posts, simply numbered, may be adopted instead of trees, but inasmuch as timber trees must be grown upon the domain, the placing them thus methodically will be simply an exaction of double usur for their standing room. The more agricultural operations can be systemized, the greater will be the certainty consequent on experimental operations. I may add, that by noting in the field the position of any plant or object which has attracted attention in connection with its nearest tree marker, a simple pencil note in a pocket book will make that tree a clue to the location of such a plant or object if it shall be wanted to be found again.

I have accommodated Agraria with a central private road, because by it every field gateway may be made to open nearer to the homestead than by any other arrangement, and all the fields may be entered independently of each other. By keeping the entrance gates of this private road locked, cattle happening to get out of their pastures will, at all events, be kept within the domain, and be saved the fatigue of wandering many miles in quest of a pound, and the risk of infection by contact with diseased cattle; and as there would probably be no occasion for other openings into the domain than by these entrance gates, it

may be kept as private and as free from trespass and intrusion as may be wished. By placing married workmen in cottages at each gate, so many watch places will be provided against depredation. Moreover, the road will give the facility of tramway arrangement for the conveyance of manure from the homestead to and through the arable fields, and of conveying forage and soiling produce from the fields home in the way of back carriage. Paved or clayed channels for the conveyance of liquid manure, or of water for irrigation, might be made along the road, and pipes for the conveyance of purer water for cattle supply might be also laid down along it; and if, in addition to all these purposes, the spare land of the road is made a grove of white mulberries, to supply food for the silk worms of the domain, and to support an avenue of vines (a double purpose to which the mulberry is applied in Tuscany, Lombardy, and some other parts of Italy, and in France also), the road will become a paying part of the domain. I shall only add in regard to the road that I have set it out a chain in width, and that it is placed so as to divide the domain into quarter sections.

With regard to the homestead, I shall for the present content myself with allotting the ample space of 13 acres, in the centre of the domain, as its site. It ought to occupy a commanding position, and though I have in the reference to the plan called No. 10 the homestead, I should probably prefer either 9, 15, or 16, if 10 happened to be flat and the others were convex. Any one, however, of the eight central fields might be adopted as the homestead, without deranging the plan, otherwise than by the transposition in the reference of two or three names to other numbers than those with which I have connected them.

Such being the proposed division and arrangement of the domain, I come now to its proposed culture, first taking the *arable department*. It will be seen by the accompanying tabular statement, that I have aimed at uniformity in the quantity of land yearly in the same crop, and at keeping fields in kindred crop side by side in movement, not only during the course, but in its repetitions also—as, for instance, the two wheat fields; and the two fields in other cereal cropping will always be together, as will also the clover field and the pulse followed by clover, and the potato field and its companion field in green crop, &c., in every

TABULAR STATEMENT OF THE VICTORIAN EIGHT YEARS' COURSE OF ANGLO-AUSTRALIAN CROPPING, FOR LAND OF FIRST-CLASS STAPLE.

No.	Name.	1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.	6th Year.	7th Year.	8th Year.	9th Year.	10th Year.	11th Year.	12th Year.
First Quarter.													
3	Far north-east field	wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye $\frac{1}{2}$ barley $\frac{1}{2}$ rice	pulse, &c., followed by catch clover	wheat, and on again in repetition course.			
5	Near north-east field	wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye	pulse, &c., followed by catch clover	wheat	potatoes		clover	wheat, and on again in repetition course.			
4	East special ground	} oats	wheat	potatoes	wheat	potatoes	4 planted 10 homestead 11 clover 12 planted						
10	Homestead												
11	Clover paddock												
12	Vineyard												
21	Near south-east field		wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye	pulse, &c., followed by catch clover	wheat, and on again in repetition course.		
23	Far south-east field		wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye	pulse, &c., followed by catch clover	wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat, and on again in repetition course.		
13	Orchard	} ..											
14	Lucern paddock												
15	Home paddock												
22	South special ground												
2	Far north-west field			wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye followed by catch clover	pulse, &c., followed by catch clover	wheat, and on again in repetition course.	
6	Near north-west field			wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye	pulse, &c., followed by catch clover	wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat, and on again in repetition course.	
1	West special ground	} ..											
7	North cow pasture												
8	Cote paddock												
9	Hospital crefts												
20	Near south-west field				wheat	potatoes	potatoes	clover	wheat	green crops, &c.	$\frac{1}{2}$ oats $\frac{1}{2}$ rye followed by catch clover	pulse, &c., followed by catch clover	wheat and repetition course
24	Far south-west field				wheat	green crops, &c.	potatoes	potatoes	wheat	potatoes	$\frac{1}{2}$ barley $\frac{1}{2}$ rice	clover	wheat, and repetition course
16	East sheep pasture	} ..											
17	West sheep pasture												
18	South cow pasture												
19	Water meadow												
25	Private road												

16 } made sheep pastures.
17 }
18 } made cow pasture.
19 } made water meadow.
road made and mulberry trees and vines planted.

recurrence, so long as the course is abided by. This arrangement, by concentrating all similar cropping and operations into one locality, will expedite them much. I have made wheat and potatoes the cardinal crops of my course, because of their paramount importance as the chief food of man. It will be obvious that first-class land only can be expected to sustain the course which I am about to prescribe, and I shall therefore, in compliment to my adopted colony, distinguish it from any other course which I may prescribe, by the designation of "The Victorian Course." It may be right to explain that in adjusting the rotations which I suggest, I kept these deductions of experience constantly in view: "Fibrous rooted plants, which throw up seed stems with few leaves, thrive well after those with fleshy roots and many succulent leaves on a branching stem: as, for instance, wheat thrives well after beans, vetches, or clover; and barley and oats after potatoes, turnips, and carrots;" and "perpendicular rooting plants and such as root horizontally, should succeed each other."

The far-famed four-course system of Norfolk, which was long the pride of British husbandry, having at length failed as to two of its crops,—and by that failure proved that the course was too short,—I have thought it right to extend my course to eight years, for which I have, as before stated, provided eight equal sized fields. The course alternates between the cereals as to one moiety of the cropping, and as to green crops, roots, pulse, maize, and clover, &c., as to the other, and runs thus: (1) wheat; (2) potatoes; (3) barley and rice; (4) clover; (5) wheat; (6) green crops and roots, &c.; (7) oats and rye; and (8) pulse, &c., and maize, &c., followed by catch clover; and then wheat again, and on in repetition course. The quantity yearly in each crop is intended to be uniform, and to stand thus: wheat, 78 acres; barley, $19\frac{1}{2}$; rice, $19\frac{1}{2}$; oats, $19\frac{1}{2}$; and rye, $19\frac{1}{2}$; potatoes, 39; clover, 39; green crops, &c., 39; and pulse, &c., followed by catch clover, 39 acres. I assume that it will take even an active cultivator four years to bring his grant under cultivation, and that he will break up a quarter section yearly. If his capital is scant he may be much longer, but of course the sooner he can get it under profitable yield the better. The tabular statement also shows the proposed preliminary cropping of the second and the third departments, until they respectively take permanent destination. In fixing

that preliminary cropping, my great object was to get the land well tilled, lined, and manured, and to exact from it, in return, as much as it can be made to yield towards the cost of bringing it into cultivation. The freshness of the land, and the fact that it is immediately to pass out of aration, concur in justifying heavy cropping for the short period prescribed for the preliminary process.

I shall now offer a few remarks on the crops which I have adopted as those of the Victorian course.

(1 and 5.) *Wheat* being, as I have before observed, the chief food of man, has assigned to it twice the area allotted to any other crop. I consider the arrangement of Providence by which land bears wheat willingly and remuneratively longer in succession than it is known to have done in regard to any other crop, very benign. Land has sickened of clover, grown shy of turnips, and refused to grow oats beyond a given repetition, but it has never yet shown any symptom of dislike to wheat; and though in the Norfolk course it has recurred every fourth year, approaching a century, and that too in turnip and barley soils, which are not the best for wheat, it is yet an acceptable crop to the land which has been under that course. My own English experience enables me to adduce the corroborative testimony of the parish under Jethro Tull's course for 130 years, to which I have adverted at the commencement of this essay, when calling attention to the churlish and impoverishing tendency of oats. Wheat has been found to respond so well to the application of lime, and to luxuriate so much in growth after its favorite preparative, clover, that it is universally allowed to be good husbandry to lime clover leys for wheat; and I shall therefore prescribe that practice in my course, in order that the wheat crop may be periodically fed with the aliment for which it has shown predilection; and I have also contrived so to place my catch crop of clover as that the wheat crop shall have the benefit of the extra humus which lime will manufacture from the roots and bottom-stems of the catch-clover, and the vegetable remains of the preceding pulse crop. Experience has also taught that beans, peas, lentils, vetches, and the pulse family generally, maize, millet, sorghum, (which is also of the millet family), gramme (which is also of the vetch family), buckwheat, hemp and flax, which, in my rotation,

accompany the pulse crops, are all friendly precursors of wheat; so that if manure proportioned to the exhaustion consequent on some of the supplemented cropping is applied with such of it as has an impoverishing tendency, I think the wheat crop will not be jeopardized by the extra duty imposed on the land by the introduction of the catch crop of clover.

(2.) *Potatoes*, being next in importance to wheat as the food of man, and especially important in a mining colony like Victoria, demanded an entire field in my course, to which I have assented, notwithstanding the known exhausting tendency of the crop, and the fact that it has not hitherto occupied so dignified a position in any English course considered orthodox. The extent to which potato cropping has been carried in Victoria for some years past, indicates the intention of the colonists to adopt it as a standard crop; and, looking to the requirements of a mining population, they are right. I assign to the potato crop the first preference share in the homestead manure of its year, for which it will yield good return. As the climate of Victoria has been found to ripen this crop at three periods of the year, that circumstance suggests the feasibility of double cropping the field in potato rotation between its wheat harvest and its barley seedness, a subject to which I shall afterwards revert when I discuss the question of double cropping.

(3.) *Barley and Rice*.—I am partial to a barley crop, and willingly allow it half a field in my course. It is liked by land, and is an orthodox crop on suitable soils in every popular course. It has the merit also of having stood the test of the Norfolk course, *sans* symptom of failure; and, as an Anglo-Australian population will always (despite temperance leagues) be malt and hop consumers, and as I have seen much first-class barley land in Victoria, I shall venture to predict, that if Sir John Barleycorn, Knight of the Southern Cross, has justice done him by Victorian brewers, "Bass's Straits ale" may peradventure in the sequel surpass in potency and renown the beverage of "Mister English Bass," famous as it is. The rustic proverb that "Barley likes a feather bed," is much to the point, and the crop following as it does in my course its favorite preparative, potatoes, will experience great benefit from the tilth demanded by that crop. It has frequently occurred to me that possibly the supposed non-adaptation of Australian soils to barley growing originated in the injudicious

attempts in the early days of Australian settlement to grow it on the stiff clays of Sydney localities, under the mere scratch surface operations then in vogue, which could only end in failure. I have seen splendid crops of first-class malting barley grown in Essex on strong soils of great tenacity, but the land was prepared for the crop by a previous summer fallow, to give it that feather bed tilth, without which barley cannot be successfully grown. Summer fallowing for the barley crop is a prominent feature in the agriculture of Essex, and is perhaps indispensable in the humid climate of England.

In regard to rice, to which I allot half a field, I am surprised that it has yet to be introduced into the colony; for, as a cereal, it is second only in importance to wheat. An attempt of Sir Joseph Banks, in 1798, to introduce its culture into England is recorded in the second volume of communications to the English Board of Agriculture. His attempt demonstrated that at all events as green food for cattle it was worthy of English culture. He states that he had not observed any corn tiller so much as his rice had done, for though at first it was thin on the ground, it soon became a dense, compact bed of plants, with blades in some of the kinds standing closer to each other than the thickest sown barley ever did. These at the close of August had become from a foot to eighteen inches high, and the plants still continued to tiller, each root having by that time produced from ten to twenty offsets, but no symptom of a rising stem was visible. In the middle of September they had still continued to tiller and to lengthen in blade, so that some were two feet long, but Sir Joseph having been taken ill, was obliged to desist from observing further progress. A frost soon after followed, which cut the blade down to the earth, and destroyed the hope of producing grain on that trial. His sowing was in the open air, and his seed was of several mountain varieties from India. Had he used seed somewhat acclimatised, and sown earlier, the result might have been more favorable as to grain. I have read that a field of rice was, under favorable circumstances, matured on the banks of the Thames near Windsor. The superior quality of rice grown in Carolina (where it was introduced incidentally) to that of the country which produced the seed, is an encouraging circumstance to Australian cultivators. As a variety sufficiently hardy for South Victoria, and to thrive without irrigation, would be a great blessing to the

colony, its introduction ought to be an object of early attempt. That which is successfully cultivated in Lombardy may surely (so far as climate is concerned) be expected to thrive in Victoria. In Java it is the regular practice to exact a green forage crop from rice before a grain crop, and why not in Victoria? A plant which tillers to the extent of from ten to twenty offsets, will be found an invaluable accession to the forage supply of the colony. There can be no question but that the super varieties of rice will succeed in North Victoria, and that in favorable localities irrigation may be applied to some extent. I may add that by simply reversing the ends of the field when it comes a second time in rotation, neither barley nor rice need be produced on the same land oftener than once in sixteen years.

As rice will be a new product in Victoria, I avail myself of the opportunity on revising for the press, to introduce the following quotation from Stuart's Travels in North America, in 1830: "Rice was first introduced into Carolina by a vessel from Madagascar, the master of which made a present of a small quantity to a gentleman in Charleston, who sowed it in his garden, where it grew luxuriantly. It was, in the beginning, raised on the uplands, where, however, it turned out that cotton was a more profitable crop; but the water culture of this grain, which was subsequently introduced, has rendered it a most valuable crop, both to the state and to individuals. No grain yields more abundantly. From 40 to 70 bushels an acre is an ordinary crop, but 80 and 90 bushels are often produced on such strong lands as have the advantage of being overflowed from a river or reservoir. The water is not let in upon the field until after the second hoeing, and it is kept on frequently for thirty days. Far more rice is produced in South Carolina than in any of the other states; but it is a *hardy plant*, and may be produced in any of the low lands, from the Mississippi to the Delaware."

I also adduce with satisfaction, the testimony of Dr. Mueller, that he found true rice, in a spontaneous state of growth, in the interior of Australia; which I consider encouraging both as to rice and cotton, because, the Doctor adds, that rice was usually concomitant, as a cultivated plant, with cotton.

(4.) *Clover* being the best known preparative for wheat, the best resting crop for land, and a meliorator of soil into the bargain, well deserves an entire field. The Norfolk practice of preferring cocksfoot grass (*Dactylis Glomerata*) to ordinary rye grass as an admixture with clover was an improvement on the older practice. The old annual variety of clover has certainly become a precarious crop on land which has often grown it, but the cause has not yet

been satisfactorily ascertained. Probably the best remedy will be found in a new variety. I apprehend that the hybrid species between *Trifolium Pratense* and *Trifolium Repens*, called *Alsike*, will, if taken alternately with the annual red (or in tertial succession with the perennial red, called *cowgrass*, and the annual red), so lessen the evil as to make it of little consequence in Victoria where the land is all fresh. It is not unusual in Italian husbandry to make a clover crop respond thrice to the demand of the scythe, viz., an early spring mowing for soiling supply; a summer crop for store fodder, cut just before flowering; and then the seed crop; but some irrigation is required to effect so much. I shall afterwards revert to clover when I come to the pulse field.

(6.) *Green Crops, Bulbs, and Roots, &c.*—In the cropping of the potato field, and of this its companion field in rotation, I foresee great climate advantage to the Australian agriculturist; and I have a presentiment that winter will in the sequel become the Australian harvest season for turnips, cabbages, and the hardy brassicas, which, owing to the ravages of the *aphis*, have become too precarious for culture as summer crops. When Australian entomology shall have ascertained the degree of cold which these *aphis* pests cannot endure, we can balk them of their prey by timing successions of their dainties, when it will be death to them to feed, should they happen to be otherwise than inert at crop time. Swede turnips and yellow Aberdeens, and some other hardy turnips, and many British cabbages, and winter carrots, parsnips, British rape, and other hardy brassicas, and perhaps chicory, white mustard, kohl rabi, and some Scotch acclimatized beets, and other forage plants, will all respond to Australian winter culture, and yield crops sufficiently matured for soiling purpose, if not as store products. It will be desirable to keep as much of the summer season of this field as is practicable open for the cultivation of the sugar beet, which will probably become a staple product of South Victoria. There are other beets worthy of summer culture, as are also French and German cabbages, and many Spanish and Italian and other south European esculents, of which we as yet know but little. To what extent *mangel-wurzel* may by Scotch acclimating be made a winter product of Victoria, is a matter of great importance to the colony, and worthy of inductive investigation. Some summer turnips, carrots, parsnips, brassicas, &c., to keep up a succession of soiling food will be indispensable where a large dairy

is kept; for it is to be borne in mind that in Victoria the reverse of English practice will obtain, and the storing of cattle food will be for summer use, and not as in England, for winter supply, so that however desirable beet-sugar culture may be in South Victoria, its ground must be shared by the mangel-wurzel crop, if a sufficient supply cannot be grown in winter, because cows must have summer food. America will doubtless supply many edibles, both for the winter and the summer cropping of this field. I assign to this field the second preference share in the homestead manure for the year of its rotation. I have contented myself with mentioning such crops as occur to memory, as illustrating the scope which I think may be taken in the winter and summer cropping of this field, though I am aware many other plants can and ought to be included, when its cropping receives matured adjustment. Carrots which afford much hay fodder from their tops when dried do so well in Victoria as to be in my opinion one of the most important of our soiling plants, both for summer and winter growth.

(7.) *Oats* and *Rye*.—I assign half a field to an oat crop, because of colonial predilection for it as cereal hay, and because of its own intrinsic importance as a grain crop in a colony where many horses will always be kept. I may observe that, though I suspect that over oating will become a vulnerable point in Australian husbandry, I am individually endeavoring to avert such a sequence, for I only introduce the crop once in eight years, and by simply reversing the ends of the field when it comes a second time into this rotation, and making the oats follow the rye, and the rye follow the oats, the same land will only be called upon to produce oats once in sixteen years. A similar observation may be made in respect of the barley and rice field, and the field in rotation for pulse, &c.

Rye springs early, and has great merit as green food for sheep, and in soiling practice. It tillers much and responds well to repetition mowings, yielding greater bulk than oats. It is also of quicker growth, and will be found a reliable resource in dry seasons in aid of the pastures of the domain. The grain is extensively used on the Continent for distillation, and there is no reason why sterling Hollands shall not supersede the blue ruin stuff made from nobody knows what.

(8.) *Pulse*, &c., and *Maize*, &c., followed by catch clover.—

The haulm of pulse is such a favorite food of sheep, and the cropping is so genial to land and so necessary for many purposes, that its omission in a course of cropping would be an imperfection. I, therefore, assign half a field for the growth of beans, peas, gramme, vetches, lentils, and any other pulse found worthy of Victorian culture, and the other half of the field for the growth of maize, buckwheat, sorghum, hemp, flax, and the lesser millet, and any other products suitable for annual field culture, which may be thought desirable, and for which place has not been before assigned. Maize, millet, buckwheat, sorghum, and the vetch family have responded willingly to the yield of immature cropping as green forage, before the render of their main crops; but to what extent beans, peas, and lentils will do the like is a matter for ascertainment. This field is one of those as to which, by simply reversing the ends of the field when it offers itself a second time in rotation, the same land will not be called upon to produce like and like cropping oftener than once in sixteen years, which in some cases may be a great advantage.

The husbandry of Italy suggests a catch crop of clover as to both halves of this field, which I think worthy of introduction into Victorian practice. It is this. *Trifolium incarnatum*, a variety of clover of rapid growth, is sown in autumn, mixed with Italian rye grass, which is of like rapidity as to growth. The sowing is begun immediately after the preceding cereal crop has been harvested, and the clover is ready for cutting as green food in the following spring, a fortnight earlier than lucern, and is, therefore, the more valuable. Its adoption in my course, after the primal crops of this field, will have the effect of bringing the whole 78 acres coming into wheat rotation into a clover ley preparation for lime. Though I do not like the recurrence of clover so often as every fourth year, which is a result of this catch crop, I may state as favorable features in the case that all my clovers, and also their admixed grasses, may be of different varieties, and made to alternate in succession among themselves. The object is, however, very great; there being not only the value of the clover crop for consideration, but the great benefit of the clover ley preparation for wheat also.

Having broached the subject of *catch cropping* (as the practice of taking two crops from the same land in a given period has been aptly called), and having got through the cropping of my chief

course, I shall now make a few observations on a subject which I consider fraught with great good or with great evil, as it is used with judgment, or abused by injudicious management. If catch croppings are allowed to jeopardize main crops, or if great produce is exacted from the land without due replenish by manure, and so as to incapacitate it for its routine duty, the evil may be greater than the good, and incalculable mischief may ensue. Unquestionably the climate of Australia gives great facilities for catch cropping, and for repetition mowings and grazings of the cereals, and I am inclined to estimate Australian sunshine at a high rate in connection with its husbandry. I observed it stated in the report to which I have adverted, that potatoes, turnips, sorghum, and mangel-wurzel had all been taken as second crops either after oaten hay, or barley cut in the spring for green fodder; that barley had been succeeded in the same year by sixty days maize; that peas, vetches, and potatoes had yielded crops at three periods of the year (I suppose an early crop, a main crop, and a late crop); and that potatoes after barley of the same year might be depended upon. Other instances will, no doubt, occur as colonial culture progresses, but those already stated are very encouraging, and indicate great capabilities both as to climate and soil. They also suggest great scope both in crop rotation and catch cropping.

In regard to the potato field, it is my opinion that if British rape is sown immediately after wheat harvest on that part of the field which is destined to produce the third division of the potato crop, it will supply much soiling food up to a late period in spring, when it may be allowed to run up into seed, which will have time to ripen before the land will be wanted for the last division of the potato crop. I mention British rape in preference to the cole variety of the Continent, because I happen to have seen much of its culture, and think it likely, from its habitat, to be the hardier variety of the two; but I should advise the introduction of both varieties, in order that their comparative merits may be tested both as to cattle food and oil. I give to the rape crop the last potato land purposely for the production of oil. I have seen farm-made rape cake of good quality, and if the Victorian agriculturist shall not, for want of machinery, be able to make the best of his oil he may, by mixing it with proper substances, increase the quantity of of his cake, and convert it advantageously into beef and mutton. Winter beet and mangel-wurzel may be taken from that part of

the potato field which is intended for the first division of the potato crop, because (even if immature and not of great weight) they will come in opportunely for the dairy cows; and the bulk of the field intended for the main crop of potatoes may be planted with hardy British cabbages of many varieties, to keep up a constant succession of fusiform rooted brassica food, until the ground must be cleared for potatoes. If this brassica and beet catch crop is taken, it ought to have a liberal allowance of guano. By planting the brassicas, rape and beet, in drills crosswise of the field, and the potatoes lengthwise, both crops will to a great extent have fresh land.

Half the winter crop of the companion field to that in potatoes is intended to be Swede turnips and yellow Aberdeens, or other hardy turnips; also hardy carrots, parsnips, chicory, white mustard, and colza, followed by sugar beet as the summer crop of that half. The other half of the winter crop is intended to be Scotch acclimatised mangel-wurzel, followed by summer turnips, carrots, parsnips, and chicory, and by yams, onions, Strasburgh and French cabbages, and by warm climate bulbs, roots, tubers, and plants admitting of annual field culture, which may, on trial, be found worthy of reception into the Victorian course of cropping. Guano will be found to be an eligible manure for the winter cropping of this field, because, as a stimulant, it will invigorate vegetation in the winter, and the rain will well diffuse its fertilizing properties in the soil.

My leading eight years' course is avowedly for land of first-class staple only, be that land limestone formation, or of volcanic origin, or a well proportioned admixture of clay and sand, known as a clayey loam; and though the development of that course was the leading aim of my essay, I shall prescribe the following rotations for land less favorably circumstanced as to staple, making use of well understood though untechnical terms:—

For an eight years' course on land of a loose texture, and of insufficient staple for the leading course, I would suggest—1, oats; 2, potatoes; 3, rye; 4, clover; 5, wheat; 6, green crops and roots, and especially the Jerusalem artichoke; 7, millet, lentils, and vetches in equal proportions; and 8, buckwheat, with vetches on the land after millet; and then oats again, and on in repetition course; liming the clover ley for wheat, and manuring heavily

with homestead dung for the potato crop and the green crops, but adhering in this course to single cropping, because such land will not sustain catch cropping.

For an eight years' course on a light loam (such, for instance, as is known in England as a turnip and barley soil) I would suggest—1, oats and rye; 2, clover; 3, wheat; 4, potatoes; 5, barley and rice; 6, peas, vetches, gramme, and catch clover; 7, wheat; and 8, turnips, mangel-wurzel, beet, cabbages, roots, and green crops, but adhering in this course also to single cropping, save as to the catch clover.

For an eight years' course on a strong clay soil approaching to stiffness, I would suggest—1, oats; 2, clover; 3, wheat; 4, Swedes, mangel-wurzel, and potatoes; 5, barley; 6, beans, vetches, maize, and sorghum; 7, wheat; and 8, rape and cabbages, &c.

I now approach the very important question of *repetition grazings and mowings of the cereals* as green crops and fodder, before they are called upon to yield grain. That the cereals possess vitality beyond most other plants, and exert an inherent power to repair damage by frost or accident, by a process called tillering, has been long known, but the systematic application of that power to profit in a cropping routine has yet to be made, and probably Victoria will initiate the practice of subjecting this process to inductive sway.

British husbandmen were probably the first to notice the beneficial exercise of the tillering process. The wireworm grub, by eating through the newly-germinated stem of wheat, did incalculable mischief, and when the germ was eaten close off the plant perished; but if a particle of it was left the inherent power to tiller, though previously inert, sent forth shoots which became stems to the original root, and produced many ears of wheat instead of one. Pursuing this hint of nature, an intelligent farmer, who happened to have a thinly-sown crop, eat it down with sheep, to induce a tiller to thicken his crop; and this being successful, it became a practice, whenever the saving of seed was an object, to sow thin, and draw upon the plants for seed deficiency by a tiller. Circumstances, however, which have prevented the British farmer making much of the tillering property, and of cereal vitality, do not obtain in Australia; but the very

converse is the case. The British climate is moist, the season is generally wet, and when it does happen to be dry and favorable at the time of depasturing the grain crop, the farmer dare not linger in the field for the sake of the food, but draws his flock off as soon as his one object has been accomplished, lest a stern British winter should overtake him before his grain is ripe. Now, the Australian cultivator, having abundance of dry weather for depasturing his cereals, may make them regular sheep pastures, if he chooses that course; or he may mow them periodically for soiling supply, if that answers his purpose better; and having no dread of a British winter, he can calculate the sunshine he will want to flower, seed, and ripen his grain; and can induce the flowering process just when he wants it to ensure the clearing of the ground for the crop next in succession.

Up to the stage next precedent to that of flowering, the stem and leaf, or blade-producing powers of a plant, are those which govern its existence and impel it onwards to seed. If the blade of a cereal is damaged or destroyed, it is re-produced, perhaps stronger than before; and the only consequence is delay in the progress of the plant towards seeding. If the land is in heart, and the plant is healthy, repetition grazings and mowings will exact a great amount of stem and leaf, or blade produce, before it need be allowed to push into flower. It is critical to deal with a plant in flower, and destruction to it to interfere in a seeding state, for the moment the seeding power is called into operation, the stem, leaf, and flower-producing functions all merge in that of the seed-power, which thenceforward becomes the governing power of the plant. The exact point, either before or in the flowering stage, at which cereals may be mown, with a certainty of reproduction, is so important to the husbandry of Australia that it ought to be an early subject of accurate investigation, it being certain on the one hand that the more fodder is matured, before it is cut, the greater is its value; and, on the other, that the grain is jeopardised if a fodder crop is taken a day later than nature warrants. In a colony yet devoid of perennial pastures and meadows, it is very important to be able to make the best of the cereal supply, and to fix with certainty not only the precise time of severance, but the number of mowings to which a crop will profitably submit; for, if the older colonists are right in their supposition that, as a general rule, the cereal supply is to be the

reliable resource of the colony for hay fodder, the enquiry assumes the greater consequence; and it may be well to extend it to sorghum, buckwheat, maize, the lesser millet, vetches, rape, and all other plants from which it is intended to exact immature contributions towards soiling supply; and to ascertain also the extent to which the beets, and other similar plants, will submit to be despoiled of their leaves without injury to their more important products. All the cereals (unless rice shall prove an exception) will admit of autumnal sowing in Australia, and of growth during its winter, so as to yield an immature scythe contribution to the soiling department in early spring.

Theorists reputed sound have stated that crops fed off in a green state, or mown before the seed was formed, might be repeated time after time, and kind after kind, with safety; it being only (as they state) in responding to the production of seed that soil is impoverishingly drawn upon: and it has, in consequence of that statement, been inferred, that when cereals are mown for hay before seeding, they take but little out of land. My impression is, that that conclusion has been pushed too far, and that the effect of the impulsive effort of germination on the land, has not been sufficiently estimated.

The seeds of most plants have a structure from which one stem only can proceed, but the cereals which yield human food benevolently depart from that structure. In them the embryo plant is so organised as that many stems spring from one grain. That departure is the origin of the tillering process to which I have adverted, and its importance in a climate in which full advantage can be taken of such a benignant provision, is my motive for giving it such a distinctive notice in this essay. It will be a singular coincidence if the oft quoted observation of Swift, in his *Gulliver's Travels* (which, bye-the-bye, was a theft of Swift's from Rabelais), "that the man who caused two stalks of corn, or two piles of grass, to grow where only one grew before, is a greater benefactor to mankind than all the philosophers, poets, orators, and politicians, that ever existed," shall be first systematically acted upon in the husbandry of Gulliver's own country (for beyond question Capt. William Dampier was the Lemuel Gulliver of Swift); and that it shall be applied to the extent of taking three croppings from the cereals instead of one—viz., a grazing of the blade crop by sheep to induce a tiller; a mowing

of the succession shoot, as green forage for soiling supply, or as dried fodder; and in the sequel—the grain crop itself.

I have before stated that the Javanese exact a cereal fodder yield from rice, as well as a grain crop; and I think it important to save land from the tantalization of several impulsive germinating efforts, where one may suffice. The saving of the seed and labor of several sowings for an object which one sowing will effect, is also a consideration.

On revising for the press I have to add that the fact that the cereals are to some extent biennials upholds my conclusion as to their ability to respond to repetition croppings, and I am glad to be able to adduce confirmation of that conclusion. Lawrence, in his *Farmers' Kalendar*, the third edition of which was published in 1801, writes thus:—"Upon soils, where wheat is apt to grow rank or winter proud, it is the custom to feed it down in the spring with sheep, and in some parts of Kent and elsewhere, even with bullocks and horses, up to the month of May." "Wheat, prevented by grazing from growing to seed, becomes to some extent perennial, and endures as grass. It remains to be determined, by experiment, to what degree it is advantageous to grow wheat, barley, and oats as soiling food, or as hay for cattle; at any rate the nutritious and fattening quality of such provender cannot be questioned." But W. P. Taunton, Esq., in his prize essay on rye, published in the seventh volume of the *Journal of the Royal Agricultural Society of England*, carries the matter much further than Lawrence, and thus writes:—"I have known an excellent farmer, who had abundance of manure from a fully stocked yard and stable, to mow his wheat crop for stable food currently twice, and in one instance thrice, in the summer, and afterwards to ripen a crop of the grain of wheat in each case; in many instances a good crop; but his fields were like a hot bed, and if he had not mown them the wheat would have lodged and rotted on the ground. Wheat is in truth the most nutritive and the most productive, though not the earliest, of all the soiling crops; and those few fortunate persons who complain that their land is too rich for wheat would, if they were to cultivate wheat thereon as a soiling crop, enjoy a most abundant and profitable return therefrom." "The beautiful variety of barley, called *hordeum bulbosum*, has been found when in flower to raise its second crop of culms to perfection in the same summer."

Though I do not subscribe, without reservation, to the dictum of Olivier (a member of the French Institute), that the intervention of beans, or of turnips, and such crops after wheat or oats, &c., is certain and complete destruction to the Tipulæ, Muscæ, and other insects which prey upon the roots of the cereals, because I know of too many instances in which tenacious vitality carried both insects and larvæ existing through adverse alternation in cropping; I am, nevertheless, willing to admit that a systematic alternation which limits cereal cropping to a single year, and

prohibits even a kindred crop in succession, is likely to keep them much under, and that therefore to that extent alternate husbandry is decidedly beneficial as a counteracting agency both against insect rapacity and vegetable malady.

The following quotation from an essay by Lawes, an agricultural chemist, published in the *Journal of the Royal Agricultural Society of England*, well justifies the importance which I have given to wheat and to the other cereals in my Victorian course of cropping:—"The climate of Australia combines in an eminent degree the small amount of rain and the high temperature necessary for the perfect development of corn, and the wheats imported from that island obtain a price in the market very much beyond those of English growth."

The colony of South Australia deserves the grateful remembrance of all the Australian colonies for its masterly representation of the whole at the great English Industrial Exhibition of 1851. I devoted a day to the examination of Australian exhibits, and chuckled at my anticipated connection with a region which could produce wheat weighing as was stated 70 lbs. to the bushel; and being, after a residence of two years in Victoria, certain that all the cereals will become its staple products, and that the soil of Victoria will enable its colonists to compete—as to wheat with South Australia, as to rice with Carolina, and as to barley with England, I cannot but regret that Victoria has not by forethought provided champion samples of all the cereals for the forthcoming English Exhibition, and that such an eligible opportunity for announcing to the civilized world the great cereal capabilities of the colony should have been thoughtlessly lost.

The second, or grass land, and live stock department of Australian husbandry, admits also of systematic management, and may be worked harmoniously and well, in conjunction with the arable land, as I will show. I shall arrange the various objects of Australian animal and zoological husbandry care into twelve classes, and briefly treat of each; premising that, according to the statistics to which I have before adverted, the live stock of the colony numbered, on the 31st March, 1859, 5,578,413 sheep; 699,330 cattle; 68,323 horses; and 37,756 pigs. Poultry and the minor quadrupeds are not stated. Over five millions of the sheep belonged to squatting stations, and that circumstance shows the extent to which the pastoral interest of the colony has developed itself.

I have assigned to the live stock department the eleven fields before mentioned, of which the two cow pastures together contain 52 acres; the two sheep pastures, 26 acres; the two general pastures, 26 acres; the two hospital crofts, 13 acres; the permanent clover pasture, 13 acres; the lucern pasture, 13 acres;

and the water meadow, 26 acres. In all 169 acres, in addition to the yield of the arable department, in the way of cereal herbage, green forage, and hay; and to the render of the two green crop and root fields, and of the two clover fields; supplemented by the straw and haulm of the grain and pulse crops: and when it is considered that Sir John Sinclair estimates the straw yield of an average British crop of wheat at 30 cwt. to the acre, of rye also at 30 cwt., of oats at 25 cwt., and of barley at 20 cwt.; and that on the data of Sir Joseph Banks, it may be safely assumed that rice straw would at least equal that of wheat, it will be apparent that under soiling management, a large dairy and a goodly number of breeding ewes and fatting sheep, may be kept on Agraria Domain, and that its homestead manure will be considerable.

Sheep constitute my first class of the animals of Australian care.

The annals of husbandry do not disclose any circumstance so astonishingly interesting and successful as the shepherding of Australia. That sagacious colonist of the mother colony, John Macarthur, having observed the effect of the Australian climate, in improving the wool of the then mongrel sheep of New South Wales, became an Australian benefactor to an incalculable extent, by his introduction of the best wooled breed of sheep then known. He was probably not aware that his pet *Merino sheep* were descended from English flocks, which, in the days of the Plantagenets, fed on the green but bleak Cotswold pastures of England, and were then doubtless clad in the dreadnought fleeces required for a British clime; but which, in consequence of amalgamation with Spanish flocks, and the basking for three centuries in the sunny pastures of Spain, resulted in the establishment of the merino breed, predestined to produce a marvellous Australian result.

Low, in his work on the Domestic Animals of Britain, questions the English origin of the Merino breed; but I think it very satisfactorily evidenced, and will introduce a few remarks on that head in support of my view.

In Knight's Pictorial History of England (vol. 2, p. 190), I find it stated that "in 1438 a license was granted by Henry VI. to a Portuguese agent in England, for leave to export to Florence sixty sacks of *Cotswold wool*, to be worked up in clothes of gold

and silver for the King of Portugal," and that Edward IV. was said to have presented King John, of Arragon, with several English ewes and rams; and Knight refers to Tusser and other authorities quoted by Anderson in his History of Commerce in support of his statements. It unluckily happens that my copies of Anderson and Tusser have not yet arrived, and that there is no copy of Anderson in the Public Library of Melbourne, so that I cannot at present pursue the matter further than Low himself carries it in the following quotations, which I make from his own work. "In those Wolds (Cotswolds), says the translator of Camden, they feed great numbers of flocks of sheep whose wool, being most fine and soft, is held in passing great account amongst all nations." "Stow writes that in 1464 King Edward IV. concluded an amnesty and league with King Henry, of Castill, and King John, of Arragon, at the concluding whereof he granted license for certain *Cotswold sheep* to be transported into the country of Spain, which have there since mightily increased and multiplied, to the Spanish profit, as it is said." And, in another part of Low's work he says, "it has been the opinion of many that the Merino sheep of Spain have been derived from England." "Baker, in his Chronicle, says, King Edward IV. entered into a league with King John, of Arragon, to whom he sent over a *score of Cotsal ewes and four rams*." "From this slender incident it were *idle* (says Low), to infer that the modern Merino owes its origin to the sheep of England, though certainly the resemblance of the Dorset breed of England, and particularly of the variety termed the *Pink-nosed Somerset*, would seem to be sufficiently striking to give some countenance to the supposition."

With due deference to Low, I think he does injustice to his own premises by his *idle* deduction from his own quoted authorities. The twenty ewes, which would probably yield an average of ten pure English-bred rams yearly, or in that proportion, as long as any of them were kept aided by the *four rams* which were sent, on this true Jasonic expedition of the Golden Fleece were, in my opinion, more than sufficient to produce in three centuries, by the crossing of large Spanish flocks and the progressive ratio of in and in breeding—the Merino breed as it stood in 1764—when it first began to be much noticed.

That Spain, as well as England, had, anterior to 1464, a fine-wooled breed of sheep, is clear; and Spain has yet other varieties

of sheep which are fine-wooled, but lack the brand of the "Pink-nosed Somersets" with which the four Cotswold Jasons and their youngster kin stamped their progeny by the Spanish ewes.

The Cotswolds of 1464 appear to have been a different race from the oldest of two breeds now known by that name, which appears to have supplanted the finer-wooled flocks early in the last century. Low surmises, and I think rightly, that the first Cotswolds were of the Ryeland family, and supports his view by a quotation from Speed, who wrote in 1629. "In Herefordshire, especially about Lempster, and on those famous hills called Cotswolds, sheep are fed that produce a singular good wool, which, for fineness, comes very near to that of Spain, for from it a thread may be drawn as fine as silk."

Low appears to think that the Spanish Merino owed something to an earlier (African) cross, which I think probable. His suggestion that the oily secretion of the skin which characterizes the breed is of African origin, is worthy of consideration, and I therefore call attention to it as a hint in what direction an Australian Bakewell is to look for that property when he wants to clothe a new Leicester carcass with a Merino fleece, which would, in my opinion, be the best Australian alliance between wool and mutton.

"Several of our annalists," says John James in his History of the worsted manufacture of England, published in 1857, "have narrated that in the reign of Edward the Third, and again in that of Edward the Fourth, a number of English sheep were, as a great boon, allowed to be transported to Spain to improve the Spanish breed, thus denoting that the English wool was then superior to the Spanish. Very conclusive confirmation on this point is given by Capmany (in his '*Memorias Historicas sobre la Marina, comercio y artes de la antigua ciudad de Barcelona*,' of which an edition was printed in 1779,) in a number of laws drawn up in the year 1438, by the municipal authorities of Barcelona, for regulating the manufacture of cloth from fine English wool (*lanes fines de anglaterra*)."

In another part of his work Mr. James says, "Proof may be adduced that from a very early period *English wool was deemed to be superior to Spanish*. In the confirmation by Henry the Second to the weavers of London of their guild, it was directed that if any weaver mixed Spanish wool with English in making cloth it should be burnt, plainly implying that the English wool was of superior quality. *It seems probable that, after the time of Edward the Third, the fleece of Spanish sheep had improved, in consequence of a number of English sheep being permitted by that monarch to be exported to Spain*. From Capmany's History of Barcelona it appears that about this period English wool was sometimes sent to that city to be manufactured into the finest

cloth then produced. Spain and England were, in this age, the only wool growing countries in the world, but that produced by the former consisted of an inferior staple, altogether unfitted in itself to make the delicate and superior fabrics of Flanders."

With that triumphant demonstration of the *idleness* of Low's insinuation to the contrary, I shall pass on to the observation that the Australian climate will co-operate with judicious crossing in effecting improvement in Austral-Merino wool, and that if no Merino rams are used but those which have pretensions to symmetry, combined with fleece-character, and aptitude to fatten, Australian-bred Merinos will soon approximate to a great degree of perfection, both in wool and mutton.

It is matter of surprise, from what small and recent beginnings, amazing results have proceeded. Bakewell, who fashioned the new Leicester breed on an ideal standard as to perfection of his own, and created a new era in shepherding, only began his practice in 1755. His first ram lettings in 1760 only averaged seventeen shillings and six pence each, and for some years his general price was a guinea; but in 1785 his price had risen to one hundred guineas for his best rams, and in 1789 he made six thousand two hundred guineas by his ram lettings, a practice which he originated, and for which he was laughed at as a foolish innovation. It is to be regretted that he (avowedly) paid no attention whatever to wool, and thought only of the butcher, though his disciples have improved in that respect.

Ellman, the great improver of the South Down breed, only began his improvements in 1780. He, however, wisely attended to wool as well as mutton, and chalked out a path in which the shepherd princes of Australia ought to tread; and Macarthur demonstrated, by what he effected for the Austral Merino breed within living memory, that "the four Cotswold rams, and twenty Cotswold ewes," were amply sufficient to produce (by crossing the Anglo-Spanish flocks pre-existing there), the Anglo-Spanish Merino breed extensive as it has in the course of four centuries become.

On revising for the press, in June, 1861, I avail myself of the opportunity thus afforded to amplify my original outline of this branch of my subject into the more finished sketch which I now present; and I do that the more readily because it is now apparent that long-wooled sheep, as well as the Merinos and the other fine-wooled varieties, are henceforth to be objects of

Australian care. I have also—under the impression that the Dishley blood will be predominant in all the long-wooled and medium-wooled sheep which will be imported from England—endeavored to unravel the mystery in which Bakewell sought to enshroud the origin of his breed, in order that Australian breeders may have a criterion for judging to what extent Bakewell's blood, or the blood of any cognate source, already pre-exists in any sheep intended to be the subject of inductive experiment.

From the days of the patriarch Jacob, who outwitted Lahan in the cunning bargain as to the marked animals, down to those of Robert Bakewell, it appears to have been a recognised point in breeding that understood causes were productive of given results, and that like produces like. Bakewell, however, appears to have been the first known individual to whom nature revealed her secret of moulding an animal to a given make, and of perpetuating that make, with its newly combined properties, in the descendants of the animals so moulded. He operated not only upon sheep, but also upon neat cattle, horses, and swine; but his greatest success was in what is now properly called *the Dishley breed of sheep*—occasionally, however, yet known by its original name of the new Leicester breed. I have here to remark that Lincoln and Leicester, being adjoining counties, had in common, at the commencement of the eighteenth century, a breed of large sheep, which appears to have had a Lincolnshire origin; though, in loose nomenclature, it was by some authorities occasionally called the old Leicester breed. The consanguinity of the old Leicesters with the old Lincolns, and the better claim of the pastures of Lincolnshire to the distinction of having fed up the breed to its great development in size and in wool, is, however, now generally admitted. Bakewell inherited, with the lease of Dishley Farm, which happens to be located on the Lincolnshire side of the county of Leicester, his father's flock of sheep, in which, all authorities agree, the old Lincoln type was predominant, and it is also agreed that that flock was the nucleus of the Dishley breed. It is, however, to be regretted that the selfish policy of Bakewell led him to mystify the origin of his breed, and to conceal from his contemporaries, and from posterity, the sources of his own success; a mistaken course, in which his memory received, in its passage to posterity, that ring-stricken brand which has marred his title to be considered as a benefactor to the agricultural community. It luckily happens, however, that the source of the Dishley blood is trackable, despite the selfishness of Bakewell, as I will endeavor to show. Arthur Young, who called at Dishley when he made his Farmer's Tour through the east of England, in 1770, writes thus in his Tour:—"In the breed of his sheep Mr. Bakewell is as curious, and I think, if any difference, with greater success than in his horned cattle."—"The breed is originally Lincolnshire; but Mr. Bakewell thinks, and very justly, that he has much improved it. The grand profit is from the same food going so much further in feeding those than any others. Not, however, that Mr. Bakewell's breed is small; on the contrary, it is as weighty as nine-tenths of the kingdom; for he sells fat wethers at three years and a half old, at two pounds a head. He sells no tups, but lets them, at from five guineas to thirty guineas for the season."

The following is the measurement, in the wool, of a three year old ram,

stated, in Young's Tour, to have been measured on the 17th March, 1770, which I transcribe, in order to convey a notion of the size to which Bakewell had then reduced his sheep :—

					Pt.	ins.
His girth	...	...	...	...	5	10
His height	...	...	...	...	2	5
His breadth of collar	...	...	...	...	1	4
His breadth over his shoulders	...	...	...	...	1	11½
His breadth over his ribs	...	...	...	...	1	10½
The breadth of his hips	...	...	...	...	1	9½

Young's visit was so opportune, and his words are so explicit, that (referring, as they do to the period when Bakewell, after fifteen years of inductive experiment, had finally modelled the breed to his mind, and was known to be breeding in and in) they have always, to my mind, been conclusive as to the Lincoln lineage of the Dishley breed, notwithstanding Bakewell's insinuations to the contrary in some of the controversies in which his want of candor involved him. My father, who was brought up a farmer, adhering to the dictum of his father—who had been a Teeswater breeder—always spoke of the Dishley sheep as Lincoln, dwarfed, and made symmetrical, by a white fine-wooled cross. What that cross was shall now be the subject of discussion.

The wool of the Dishley breed is evidently a blend of a short-wooled with a long-wooled fleece, and nature's hand to that purport will probably be among early revelations of the microscope, now that it is being applied to matters connected with wool. Leicestershire tradition—which I gathered when I went on pilgrimage to Dishley many years ago—states that the Ryeland breed contributed the short-wool ingredient to the blend, along with the fineness in bone and aptitude to thrive on scant fare, which were Bakewell's chief aims in that cross; it being to be observed that, long before his time, the Ryeland breed had acquired the repnte of possessing, pre-eminently, symmetry, with predisposition to fatten, and also fineness in bone, which were Bakewell's favorite qualities. Tradition also states that he bred occasionally from Dorset ewes, and had a liking for that blood; perhaps, therefore, it may be assumed that the short-wooled ingredient in the Dishley blend was a compound of the Ryeland and the Dorset, in proportions within the powers of the microscope to reveal; and if my surmise is well grounded, the microscope may be the key which, when applied to nature's brand-mark on a Dishley fleece, will unlock Bakewell's arcanum, and let out his long-kept secret, which peradventure, after all, when known, will amount to no more than this—that, in 1770, when he had adjusted his Dishley blood, it had in it 60 per cent. of old Lincoln, 30 per cent. of mixed Ryeland and Dorset, and the remaining 10 per cent. of various breeds, intermingled for special mutton points. It is because the Dishley blood has since become so diffused, that scarcely any English flock of note is now without it, that I have deemed it worth while to pursue this investigation to the extent which I have.

William Marshall, an acute observer, who resided four years near Dishley

Farm, and had several interviews with Bakewell, at Dishley, thus writes in his *Rural Economy of the Midland Counties*, published in 1790:—"The manner in which Mr. Bakewell raised his sheep to the degree of celebrity in which they deservedly stand is, notwithstanding the recentness of the improvement, and its being done in the day of thousands now living, a thing in dispute, even among men high in the profession, and living in the very district in which the improvement has been carried on. Some are of opinion that he effected it by a cross with the Wiltshire breed; an improbable idea, as their form altogether contradicts it. *Others that the Ryeland breed were used in this purpose; and with some show of probability. If any cross whatever was used, the Ryeland breed—whether we view the form, the size, the wool, the flesh, or the fatting quality—is the most probable instrument of improvement.*"—"The wool is shorter than long wools in general, but much longer than the middle wools, the ordinary length of staple being 5 to 7 inches, and varying much in fineness and weight."—"The origin of letting rams by the season, in the midland district, may be traced to a ram let by Mr. Bakewell, at a Leicester fair, about forty years ago, at the low price of sixteen shillings, and his letting two more, on the same day, at seventeen shillings and sixpence each; and humble as was this beginning, it proved to be the first stone of the foundation of a department of rural business that has already risen to an astonishing height, and may for some length of time continue to bring in a copious source of wealth to the country."—"Mr. Bakewell this year (1789) makes, I understand, twelve hundred guineas by three rams—brothers, I believe."

The importance of sheep in Australian husbandry, and my wish at this early stage of that husbandry in Victoria, to manifest the title of England to copartnery with Spain in the honor of having formed the Anglo-Spanish Merino breed, which Providence appears to have predestined to be the leading breed of Australia, and the urgency of the growing demand of England for longer wool, and of a Victorian mining population for larger and better mutton, has led me into details as to the blood of the two most remarkable varieties of sheep, of known origin, as yet produced, viz., the *Merino*, formed with the avowed object of producing fine wool, without much care as to mutton (for the Merino monopoly remains to this day, in Spanish policy, the mere wool guild which it was when the Anglo-Merino breed was formed by the Anglo-Spanish cross); and the *Dishley*, formed expressly for mutton—(for Bakewell is recorded to have said "that wool was no object with him; and that he did not care whether his sheep carried fleeces or not, for that one thing only was wanting to ensure him an ample fortune—the discovery of a breed of sheep without wool") As my object is that of presenting systematic and scientific views to Australian shepherds as well as to wool as to mutton, it is, I trust, somewhat more rational than Bakewell's anti-wool crotchet.

Ellman, as I have before observed, aimed, in his celebrated *South Down breed*, at a combination of wool and mutton; but as mutton will always be the predominating object with the British shepherd, whilst wool, on the contrary, ought to be the paramount object in Australian shepherding; and as I think it incumbent on Australians to form breeds expressly adapted

for their own husbandry, I shall introduce to their notice four particular breeds, viz., the "Old Lincoln," and the "Ancient Teeswater," longwools, and the "Dorset," and the "Ryeland," shortwools, as deserving of especial attention in any endeavor to attain excellence in the production of both kinds of wool, and of improvement in mutton.

The "Old Lincoln" and the ancient "Teeswater" breeds, being the giant families of the Ovis race, demand as such especial Australian notice. The following quotations from Arthur Young's *View of the Agriculture of Lincolnshire*, published by the English Board of Agriculture in 1808, will bring Australians acquainted with two ancient sheep of the *Old Lincoln breed*:—"Mr. Graves, of Spalding, had a true old Lincoln sheep, that clipped the first year 23 lbs. of wool, and the second year 22½ lbs. It was sold at Smithfield, at Christmas, and weighed 40 lbs. a quarter. Of this sheep Mr. Bakewell said that he ate as much as three; but that was mere assertion." "Mr. Trim-mell, of Bicker, near Boston, killed a wether, of 67 lbs. a quarter at four years old. He never ate any corn, oil cake, &c., but fed wholly upon grass and herbage. Being turned with many other sheep into a field of clover, it was observed to search for all the sow-thistles, and would eat no other food whilst any of them could be found; and when the field became bare of food the shepherd, guided by the sheep's propensity for sow-thistles, gathered a quantity for him at stated hours, three times a day, from 2 lbs. to 5 lbs. at a meal. Standing on his feet, he measured only 2 feet 6 inches high, and weighed, alive, 26 stone, of 14 lbs.; he gained only 1 lb. the last month, and then, thinking he had got to the top and quite ripe, he was killed on the 13th October, 1791, being then a four shear sheep. The skin, hung up by the nose, measured 10 feet 2 inches, from the point of the nose to the tip of the tail, and was sold for seven shillings and sixpence in the common course of business. The carcass measured five feet from the nose to the tail; its rump or cunion, eight inches and a half in depth; plate or fore flank, the same thickness; breast end, seven inches; one yard five inches and a half round the collar; and weighed 67 lbs. a quarter. The legs, cut haunch or venison fashion, weighed 50 lbs. each, which the butcher sold at two shillings a pound, so that the two legs brought ten pounds." Young does not give the weight of his fleece.

The following quotations from the more recent report on the farming of Lincolnshire, published in the journal of the Royal Agricultural Society of England, will give a notion of Lincolnshire sheep farming in 1851, when the Old Lincolns had, in great measure by crossing, merged in improved breeds of inferior size:—"The larger breeds chiefly occupy the south-eastern quarter of the county, and are known as 'the Lincolnshire long wools,' in contra-distinction to the Cotswold and improved Oxfordshire breeds. They partake largely of the peculiarities of both Cotswold and Leicester, having the expansion of frame and nobility of appearance of the one, combined, in a great degree, with the quality of flesh, compactness of form, beauty of countenance, lightness of offal, and inclination to fatten, of the other; but they far exceed either in the weight of their wool. They are usually kept until 27 to 33 months old, when their weight is from 28 lbs. to 72 lbs. per quarter; and the two clips of wool weigh together

about 20 to 25 lbs. Under good management this wool is of a quality which rarely fails of obtaining a price equal to that of the lighter long wools, or even pure Leicesters (*i. e.* Dishleys); and there is, therefore, perhaps no breed that can equal this in rapidity of growth, and propensity to fatten, under a fleece so weighty and valuable. Some instances of extraordinary weight may be stated: a wether sheep, killed in Holbeach Marsh, in 1844, weighed 72½ lbs. per quarter. Ten wethers were produced by one farmer, in the same locality and at the same time, averaging upwards of 52 lbs. per quarter each; and a ewe, from Long Sutton Marsh, exhibited at the Smithfield Club cattle show in 1846, weighed, when dead, 65½ lbs. per quarter, or 262 lbs. the whole carcass. In the midland and south-western parts of Lincolnshire, the sheep are more closely allied to the true bred Leicesters (Dishley's), the proportion of blood being estimated at three parts Leicester to one of Old Lincoln, and are very compact and well formed, with fine and good countenances, and rather close set but beautiful wool. They can be generally fed off, at the age of 18 to 27 months, and are noted for their large proportion of lean meat; if kept longer, it is for the purpose of taking the fleece; the two fleeces weighing together about 17 lbs., and the carcass about 35 lbs. per quarter on an average. A breeder in the neighborhood of Grantham showed a shearling sheep of this class, which clipped 17 lbs. of wool, and weighed 22 stone; being one out of an even lot of 27. In the northern, and north-eastern parts of the county, about one-fifth of the sheep are pure Leicesters, and the remaining four-fifths are descended from the original large Lincolnshire sheep, crossed latterly with Leicester rams; being thus neither too coarse nor too delicate, uniting size with quality, and having heavier fleeces, though of coarser quality, than those of the unmixed Leicesters."

The ancient Teeswater breed has passed by metamorphose into the modern Cotswolds, and its kindred breed, the improved Oxforas; and a noble breed, both for wool and mutton, *the modern Cotswold* has in consequence become. It was long a moot point, whether the old Lincoln and the ancient Teeswater were not of kindred blood: my father, who was born on the banks of the Tees, and whose father had been also born there, thought not; and William Marshall, who was also a native of Yorkshire, and my father's senior by twenty years, appears to have been of the same opinion, for he thus writes in his *Rural Economy of Yorkshire*, published in 1788:—"The improvement (in the sheep of the vale of York) has been effected by the introduction of rams of the Leicestershire and the Teeswater breeds; the former hired of Mr. Culley (a spirited and successful disciple of Mr. Bakewell), and the latter of Mr. Colling, and other attentive breeders in the neighborhood of Darlington, on the banks of the Tees. Fortunately, perhaps for the Vale, two of its most considerable farmers, to whom it is principally indebted for its present improved breeds of stock, differ in their opinions respecting the superior excellency of these two breeds of sheep, each of them propagating and encouraging his own favorite breed. Both of them are excellent, *though perhaps widely different in their origin*. Of the Leicestershire breed I say nothing in this place, as I may hereafter have occasion to speak of it fully. The Teeswater breed falls within the inten-

tion of the present work. *These sheep have been inhabitants of the banks of the Tees time immemorial.* I remember them twenty years ago, of enormous size, resembling, when their wool was in full growth, the smaller breeds of cattle rather than sheep. Their flesh nevertheless was of an excellent quality; their wool (as long wool) fine, and of an uncommon length, singularly adapted to the worsted manufactory. The present fashionable breed is considerably smaller than the original kind; but they are still much larger, and fuller of bone, than the Leicestershire breed. They are not so compact, nor so neat in their form, as the Leicestershire sheep; nevertheless the excellency of their flesh and fattening quality is not doubted, and their wool still remains of a superior staple."

In these crossings between the Teeswaters and the Dishleys, which Culley pursued; and between the Teeswaters and the old Wiltshires, &c. which the brothers Colling pursued; and an amalgamation, which subsequently took place between the two new sorts, originated the modern Cotswolds, which take name from the Cotswold district, in which they first had extensive introduction on wandering from their northern locality. As the Dishley breed had really Lincoln blood in them, it is evident from the language of Marshall, that he considered the Lincolns and the Teeswaters as being unconnected in origin.

The following quotation from Bailey's view of the agriculture of the county of Durham, which is bounded on the south by the river Tees, will bring Australians acquainted with ancient sheep of the *Teeswater breed*; and will bring down the crossing operations of Colling and Culley some years later than they were brought by Marshall:—"Sheep.—Teeswater and Leicestershire.—The lower part of this county was formerly famed for having the largest breed of sheep in the kingdom, many of them being from 50 lbs. to 60 lbs. a quarter; one in particular, a four shear sheep, bred by Thomas Hutchinsou, of Sockburn, killed and exhibited at Darlington, the 22nd December, 1777, was 62 lbs. a quarter. I saw the carcass of this sheep, and regret very much not having seen him when alive; but I saw one soon after belonging to Mr. Dinsdale, of Newsham, that weighed 54 lbs. a quarter, which was nearly the height of a Shetland pony. A lamb of the Sockburn breed, five months and four days old, bred by Henry Hutchinson, was killed at Stockton races in 1794, which weighed 22 lbs. a quarter. Soon after 1777 these great weighted sheep began to lose ground very fast, as the Dishley sheep were then making a rapid progress; Messrs. Culley having been in the habit of letting tups for several years before, by which means most of the principal breeders had gotten crosses with the Dishley sheep, and of course the size and weight of the original stock were much diminished. Some time after this Robert Colling began to visit Leicestershire, and for several years afterwards hired some of their best tups; he also purchased ewes of the most improved breeds, by which he has long been in possession of a very superior sheep stock. Charles Colling, following the footsteps of his brother, pursued the same course and with the same success."

Tuke, in his View of the Agriculture of the North Riding of Yorkshire, published in 1800, states that "a Teeswater wether, rising three years old,

bred by W. Powley, of Thornton, was killed at Leyburn, in January, 1799, the four quarters of which weighed 16 stone 11 lbs.—near 59 lbs. per quarter; tallow, 1 stone 8½ lbs. He cut 6 inches thick of fat on the rib, and 4½ on the rump." Taking age into consideration, this extraordinary wether appears to me to have been equal to the old Lincoln wether, to which I have before alluded.

Culley, who has the reputation of having originated the *modern Cotswold breed*, by the intermixture of the Dishley and the Teeswater blood, thus writes of the Teeswater breed, in his *Observations on Live Stock*, of which the 4th edition, from which I quote, was published in 1807:—"The Teeswater breed differs from the Lincolnshire, in the wool not being so long or heavy; in standing upon higher, though finer boned legs, yet supporting a thicker, firmer, and heavier carcass, much wider upon their backs and sides; and in affording a fatter and finer grained carcass of mutton, the two year old wethers weighing from 25 lbs. to 35 lbs. per quarter; some particular ones, at four years old, have been fed to 55 lbs. and upwards. Thomas Hutchinson, of Stockton, an eminent breeder and grazier, had a wether sheep, which was killed at Darlington about Christmas, 1779. The four quarters weighed 17 stone 11 lbs., at 14 lbs. to the stone, or 62 lbs. 4 oz. per quarter, with 17 lbs. of tallow (after leaving all they could in the loins); which is the greatest weight, by several pounds per quarter, I ever heard of a sheep weighing. He was of the true old Teeswater breed. There is little doubt but the Teeswater sheep were originally bred from the same stock as the Lincolnshire; but, by attending to size rather than wool, and constantly pursuing that object, they have become a different variety of the same original breed. The ewes of this breed generally bring two lambs each, and sometimes three. There are instances of even four or five, as was the case with Edward Eddison's ewe, which, when two years old, in 1772, brought him four lambs: in 1773, five; in 1774, two; in 1775, five; in 1776, two; and in 1777, two. The first nine lambs were lambed within eleven months. This breed is, at present, rarely to be found pure, except in the possession of some old breeders." I think it possible that both Culley and Bailey refer to the same individual sheep, but that is immaterial; I however call attention to the difference in conclusion between Culley and Marshall, as to the origin of the breed, though Culley's conclusion has not affected my own impression, that the old Lincoln and the Teeswater breeds had not a common origin. The prolific tendency of the Teeswater ewes is an invaluable peculiarity, which is, in my opinion, indicative of a distinct derivation, for the old Lincolns do not possess that tendency.

Henderson, in his recently published *Treatise on Live Stock*, (after adverting to the Lincolnshire and the Dishley breeds, and treating the Dishley breed as a variety of the Lincoln breed, thus writes:—"The Cotswold, or Teeswater breed, is the only other long woolled one that demands our notice, owing its celebrity to Mr. Culley's exertions in crossing the local animals with the Dishley breed. It is distinguishable from other long woolled breeds by a large tuft of wool covering the forehead, and is the heaviest of the species; likewise more compact, better shaped, and finer in the bone and quality of mutton, than any other equal in weight. These sheep are next in

repute to the Dishleys, and answer well to cross them with, hut, like all other animals of a large mould, require good land, well sheltered, and a little nursing in winter, with succulent food. They are very prolific, having mostly two, and sometimes three lambs at once: even instances have occurred of four or five being produced at a birth." I have to remark, that I think Henderson has somewhat overstated the general prolific property of the Cotswolds, and that, as his cited authority is solely that from Culley, as to Eddison's ewe, which, it is to be remembered, was not a Cotswold, hut an old Teeswater, I do not think his text, in that respect, sufficiently supported. Couples are, however, common in some flocks of Cotswolds, and I have known instances of three healthy lambs at a birth. I have seen a few fine Cotswolds in Victoria, and I think it likely that when irrigation shall make food plentiful and certain, Cotswolds, being now abundant in England, will be largely imported into Victoria. Pure Teeswaters have been long excessively rare. The last genuine Teeswater sheep seen by me were a remnant flock, located in Leicestershire, which I rode several miles, thirty-three years ago, purposely to see. The ram was aged and equal to an ass in size, and had an amazing fleece. There existed, some years ago, a feeling among sheep breeders of the larger sorts, that, on national grounds, the purest of the remnant flocks of the old Lincoln and the ancient Teeswater breeds ought to be collected together and preserved from admixture with other blood, as breeds worthy of revival, because of their pre-eminence in size, and in length and weight of wool, over every other variety of sheep. I trust that that feeling was acted upon, and that a score of the most symmetrical of the ancient Teeswater ewes, with a couple of rams, accompanied by a like selection of old Lincolns, will find their way into the Park Royal of Melbourne, and be there kept as pure breeds, for the use and benefit of such of the sheep breeders of the colony as may have occasion to revert, in sheep experimenting, to fountain head blood, in cases demanding carcass, size, and extraordinary length in the staple of wool.

To the epicure liking of the citizens of London for early lamb, we are indebted for the preservation of the *fine wooled Dorset breed* in a state of comparative purity; and if, as is probably the case, the Dorsets represent in ancestry, not only the pink nosed Somersets, the known progenitors of the ancient Cotswolds, which originated the Merino breed, but also the Ryelands, which Bakewell is believed to have used in his cross, the lamb-loving Londoners have in troth, in their palate gratification, conferred a boon on their antipodean brethren by that preservation. Fifty years before the era of Bakewell, Dorset ewes had been found to arrive at early maturity, to possess great fecundity, and to make excellent mothers. This combination of qualities led to Dorset ewes in lamb becoming very marketable animals, and to the extension of the breed in the counties contiguous to London, for early lamb supply. The broad, deep, and cow-like formation in the loin of the Dorset ewe, indicates the faculty of yielding milk in abundance; and Dorset ewes do in fact exceed every other English breed, in the production of milk, which makes them eligible as a cross for the Merinos; the ewes of which on the contrary, yield but little milk and have the repute of being bad mothers. It is said that the fecundity of Dorset ewes, indicates deri-

vation from warm climate flocks, which have the faculty of producing twice a year. Be that as it may, there are certainly English instances on record, of two lambings of the same ewe within the space of a year; and it is no unusual thing for Dorset ewes to become impregnated whilst they are nursing their young. Upon the whole, this valuable fine woolled breed possesses so many properties desirable in Australian flocks, that I marvel its introduction as a general breed has yet to be made.

Tomkins, the great improver of the Hereford breed of cattle, did much to improve the *Ryeland breed of fine woolled sheep*, located in Herefordshire, but he did not succeed in his endeavors to enlarge it to the paying size, which would have enabled him to compete with the Dishleys and the South Downs. He got symmetry, but not size; and he pleased himself as to wool: but he lived in an age and country in which mutton was at premium and fine wool was at discount. Some flocks of his improved blood lingered long in his locality, and, when I was making my agricultural survey of Herefordshire, I thought of securing a score of ewes and a couple of rams, as an Australian speculation, lest his renovated blood should get altogether lost in an influx of crossings with the Merinos, at the time John Bull (overlooking climate drawback) was, a second time, engaged in his enthusiastic attempt to supersede Spain, in a staple which Providence had reserved for his Australian sons. Both Dorsets and Ryelands are admirable folding sheep, and have been found to cross well with Dishleys and South Downs, and would, I have no doubt, by interbreed, improve, both in wool and mutton, many Austral-Merino flocks. Wool, in Australian breeding, should have at least equal development with mutton, and I look forward to the combination of care, keep, and climate, producing, when directed by intelligence, results in Australian shepherding greatly in advance of present expectation. The best Dorsets, the improved Ryelands, and the giant Lincolns and Teeswaters, might all of them be introduced into Australian husbandry to advantage; and it will be well to ascertain, by continued observation, what ameliorating effect the climate of Australia will have, not only on the long wool of the old Lincolns and Teeswaters, but also on the wool of other varieties of sheep. The *Hampshire Down* and the *Shropshire Down* are new varieties of sheep, which are worthy of Australian notice, as exhibiting good combinations of wool and mutton; the Hampshire Downs are the largest sheep of the short woolled class, and, when pasturage and sheep keep shall, by means of irrigation, become abundant, size in sheep will become a greater object in Australian husbandry than it is at present. The improved South Down flock of Jonas Webb, has justly acquired great repute, and is well worthy of Australian notice, but choice rams are very costly. With regard to Shropshire Downs, which are short woolled and bear some resemblance to South Downs, I was amused at being able, at a Victorian show, to renew acquaintance with a Shropshire Down ram, which had here taken a South Down prize, to which, though he was a fine sheep of his sort, and had to my knowledge taken high English prizes in his proper class, he had no title. The Jonas Webb part of the pedigree, tied round his neck, if not altogether fictitious, was very erroneous; and, though friend Webb might have overlooked his own metamorphose from a Cambridgeshire farmer into a Shropshire squire, he would have

thought, with myself, that the awarding judges had been men of defective vision. There are some *Asiatic breeds of sheep* worthy of being inquired after, and, perhaps, of introduction, to impart special properties to Australian flocks; especially the *purik* breed of Thibet, which lambs twice, and admit of being shorn twice in the same year. *

I do not contemplate providing domain accommodation for more than its breeding ewes and its fattening sheep, because store and clip sheep may have station care elsewhere, and so yield place and food to dairy cows, which cannot be so well managed as at home: and it will be found that, when sheep runs become of the moderate extent of a quarter of a geodetic square each (i. e., 6,250 acres) many owners of maximum domains will, either in coparceny or in severalty, occupy runs as outlying domain adjuncts; a mode of occupation of much greater advantage, both to individuals and the community, than any system of commonage.

Neat Cattle constitute my second animal class. Much as I am inclined to encourage the growth of oranges in Victoria, I am, nevertheless, of the opinion of an English sailor, alluded to by Sir John Sinclair in his Code of Agriculture, who decided that a Cheshire cheese was a nobler product than a Seville orange. The sailor had been taunted by a Spaniard with a display of oranges, which, the Spaniard said, his country produced *twice a year*; to which the sailor retorted by holding up a great Cheshire cheese, and exclaiming:—"See what my country produces *twice a day*."

The cow is a remarkably docile animal, and bears confinement so well that I am satisfied *dairying* may be profitably conducted, under soiling management, if the cows are kept in well ventilated sheds by day, and have morning, evening, and night pasturage, whenever the weather is dry and favorable. Though Devonshire men will import Devons, Herefordshire men, Herefords, Lancashire men, Long-horns, and the generality of the colonists the improved short horns; and ought, all of them, to receive colonial contribution towards their cost; my mind has been long made up, that the best breed for Victoria, and probably for the other Australian colonies also, is the improved short horns, *of the milking sort*, with two points out of three to the mind of the dairymaid and one to that of the butcher.

It will be Utopian to expect that cows of a breed predisposed to fatten, will be such milkers as those which have the contrary predisposition. Nature is, however, accommodating; and though she will, properly, refuse to ordain that the fattening propensity shall pass exclusively to the males of a breed, so as to make all the females great milkers, she will not decline to fix a given combination of the two properties, descendible to both sexes, when an Australian Charles Colling shall have produced it.

As the improved *short-horned breed of cattle* appears to me predestined to be the dominant breed, not only of Australia, but of the civilized world also, a concise account of its origin, which happened to be in Holderness, where I resided several years in the early part of my professional life, may be acceptable.

Holderness tradition attributes the great milking capacity of Holderness cows to the introduction, some ages back, of Holstein bulls, *via* the port of

Hull, which greatly improved Holderness herds, and led to a great demand for Holderness hull calves in other Yorkshire localities. Cleveland was in those days a noted dairy district, and my father, on the authority of his father, who was a Cleveland farmer and breeder of short-horns, told me that Cleveland cows had Dutch Holstein blood in them, which they got with Holderness hulls, purchased for the dairies of Cleveland; and that it was with Cleveland cows, of Holderness and Holstein lineage, that Charles Colling and his brother Robert began, towards the close of the eighteenth century, their amazing development of the short-horned breed.

The Agricultural Report of the County of Durham, to which I have before adverted, discloses, in the following paragraph, what a great result in a particular case followed a lucky incident:—"In the spring of the year, Mr. Basnett, of Darlington, purchased a cow with a hull calf at her heels, and putting her into a good pasture, she got so fat that it induced him to dispose of her to a hatcher in the August following, and the calf was sold to a farmer in the neighborhood. At four years old he was purchased by Mr. Robert Colling, who, finding him to have a great propensity to get fat, sold him to his brother Charles, who was then beginning to breed, and was anxious to select those with the best disposition to fatten. For the same reasons, and with the same view, he soon after purchased of Mr. Maynard, of Ayreholm, a cow, and a heifer, her daughter. This hull and cow, selected with so much judgment, are the original stock from which the celebrated Durham ox, and the justly acknowledged superior breeds in the possession of Charles Colling, Robert Colling, and Mr. Mason, are descended."

My father, who knew both Charles Colling and his brother, and their stock, told me that the cow with a hull calf at her heels was a cottager's cow, which he was allowed to feed in a grassy lane, where she happened to be noticed by Mr. Basnett, and that the calf became the celebrated hull, "Huhhack," the common ancestor, not only of "Comet," the first hull which sold for a thousand guineas, but also of all the Colling herd, which figure so prominently in the short-horned herd books. "He was but little for a Teeswater hull," said my father, "but he handled well, and was good in all his points. His want of size was set down to his bad keep as a calf, for the cottager's wife took care that her children shared better than the calf in its mother's milk."

The origin of the modern improvement in the *breed of Herefords* was almost as incidental as was that of the improved short-horns. It was thus. About 1769, Benjamin Tomkins, of Kings-py-on, in Herefordshire, began breeding from two cows, called by him "Pigeon" and "Mottle," bought at Kington fair for a dairy farm, of which Tomkins was the cowman. He had noticed the propensity of both cows to fatten, and on marrying his master's daughter, asked for, and had the two cows in dowry with his wife; and a famous dowry it proved to be to him.

The Herefords are not, however, adapted for dairying, which is the crowning purpose of the bovine race; and they must, therefore, together with the Devons, yield place in Australian husbandry to the milking variety of improved short-horns, which is likely to become the universal breed of the civilized world. When I made my agricultural survey of Cheshire and the

other dairy districts of England, I found the long-horns, which had long held dairying supremacy, gradually becoming of the short-horned type, by the introduction of short-horned bulls, and by the facile manner in which that type was stamped on the progeny in the very first cross; and when I afterwards made my agricultural tours through Scotland, Ireland, and France, I was surprised at the number of short-horned cows which met my eye in every direction. I was much gratified, also, at finding, both in South Australia and Victoria, more useful cows of my favorite breed than I expected to find.

As an ounce of forethought, in the ordinary affairs of life, is worth more than a pound of after-wit, because it may supersede, by anticipation, the routine of costly experiment; and as I see an error into which Anstrallians are falling in awarding prizes to fat bulls and cows at cattle shows, and in purchasing at extravagant prices English prize bulls and cows of Smithfield fame, which every man of experience knows are generally the fattest of the fat, instead of those which have taken dairying prizes; and as fatness is inimical to fecundity in the female, and to labor in the male, and, moreover, counteracts nature in her efforts to supply milk; and as we shall be long without a beef-eating population in Anstralia, I do protest against paying extravagantly high for that which is not only not yet wanted, but which may for many years to come be positively injurious. Moreover, beef will never be of the consideration in Anstralia at which it has arrived in England, inasmuch as it will have to encounter far greater rivalry with mutton than English beef ever had. The immense flocks of sheep which will be kept for what is now justly regarded as the great staple of Anstralia, will soon, in mere annual cullings, yield ample animal food for a much greater population than Anstralia is likely, for many years to come, to have to eat it. In addition to that, it is to be borne in mind, that decomposition is so rapid in Anstralia, that however desirous a country butcher might be, to treat his customers with prime Christmas beef, he would scarcely venture upon killing an ox until he saw his way to the disposal of the whole of it in as many hours as an English butcher can allow days. The greater portability, therefore, of sheep is of such moment in the rivalry between beef and mutton, as almost of itself to settle the question between them; but, when it is remembered that alpacas, llamas, yaks, goats, kangaroos, and hosts of fur-clad and other animals, together with vast supplies of poultry, swine, calves, and fish, will shortly compete with both beef and mutton, it will be obvious that, in a country which for ages to come will be without its Londons, Manchesters, and Birminghams, &c., the breeding of cattle for the mere production of beef cannot pay, and ought not, therefore, to be persisted in, beyond making the best of aged cows and of the oxen in surplusage of the demand for labor, and that henceforth the prize bulls and cows to be imported, and the awarding of colonial prize encouragement in the breeding of neat cattle, ought to be limited to those which have the milk-producing faculty in fullest development, combined with symmetry and constitutional proneness to keep in that store condition in which good keep will induce a moderate degree of fatness when the ox is to rest from his labor, and the cow is to retire from dairy duty.

There are in England several invaluable herds of improved short-horns, in which the fattening propensity was never allowed to proceed to the extent now necessary to ensure first class Smithfield prizes. Bailey, the judicious author of the Durham Report, from which I have twice before quoted, writes thus :—"It has been already stated, that the short-horned cattle were great milkers. This cannot be said of the variety which has such an aptitude to fatten, for though they give a great quantity for some time after calving, they decline considerably afterwards; but the variety of great milkers is yet to be found wherever the dairy is the chief object, and this variety is as carefully preserved and pursued as the graziers do that of the fattening tribe. It is very common for cows of this breed in the beginning of summer to give thirty quarts a day, and there are particular instances of more. Where the object is simply milk, they are probably superior to any breed in the kingdom; but in respect to butter and cheese there are some doubts as to whether they are entitled to claim a superiority or not, as the quantity of those articles does not depend entirely on the quantity of milk."

The yak of Thibet is an animal of the bovine race which appears to me to be worthy of Victorian introduction. In addition to the three-fold yield of milk, beef, and extraordinary hair, it yields also horns of superior length and make, and has a tail which is used in India as an appendage of State parade, and is therefore of commercial value. The yak is, moreover, used as a beast of burden in Thibet, and having the repute of being strong and sure-footed, I see no reason why it should not in Australian husbandry supply the place of the ass. The hair of its hump is in reality a kind of fur. The Tartars have large herds of them, which are to them valuable, for they live almost entirely on their milk. The male is five feet high, and has much the form of an English bull, but its chief dissimilarity, with other animals of its genus, consists in its sides being covered with long glossy hair, which extends over the whole body except the head and legs, and hangs from the flanks quite down to the hocks. The hair is in great request, and is sold at a high price. The doe, or cow, yields a large quantity of milk, which is rich, and produces better butter than that of any other of the bovine races of Asia. If, therefore, travellers have not over-stated the qualifications of this animal, they are, in combination, so manifold as to call for especial and early attention.

Before I pass on from the bovine race I must reiterate, that its paramount mission and crowning purpose in animal economy is dairy produce in the cow, and labor in the ox, and that the great development and prominence of its beef-yielding property, which Charles Colling and Benjamin Tomkins, and their skilful compeers, induced in their varieties of the race, would have been of little consequence elsewhere than in England, where an increasing beef-eating population demanded additional supply; and where the climate permitted that supply to be stored several days, and in cool weather a week, without spoiling, whereby a village butcher could risk the killing of his weekly ox. I have also to observe, that excessive fatness is disease, and that breeders have made that disease constitutional, by perpetuating predisposition to it. It was noticed (said my father) that though the mother of Huhback (the originator of the Colling herd) was a young

cow, she never bred after she got promotion out of the lane into good pasturage, notwithstanding the great anxiety there was after she became noticed for further calves. Sterility, the baneful adjunct of high breeding, is of dangerous tendency in a dairying herd, and ought to be counteracted by vigilant care.

It is, therefore, prize bulls and cows from herds of short-horns which have the milking faculty preponderant, and especially from the herds of Holderness, which yet supply the vast city dairies of London and Manchester, &c., &c., with their best milking cows, which I am anxious to see imported into Victoria, accompanied by English dairymaids of the cheese-making districts. I have during a long professional connection with Cheshire and the cheese-making parts of Shropshire and Staffordshire noticed, on coming in contact with factors, in their periodical cheese-purchasing visits, that they were much more influenced in their buyings by the reputation of the dairymaid, than by either the soil or the herbage of the farm; and, though I have observed that some pasturage and soils are better adapted for cheese-making than others, the result of my experience is, that more depends upon the care and management of the dairymaid in the production both of butter and cheese, than upon either the soil or the herbage of the land. It will be absolutely necessary in Australian dairying to have buildings with regulated artificial temperatures, adapted to the known requirements of certain operations connected with the making and keeping of cheese and butter; and I have, in conclusion, to urge the introduction of the cleanly system of the Flemings and the Dutch in their management of cows into Australian dairying.

Horses stand third in my animal classification. The vicinage of Victoria to the fountain head of Arab blood, and the regular communication between the colony and England, by which the best breeds of the mother country can be easily imported, are much in favor of the colonists. The horses of Victoria, in some points, surpass the generality of the farm-bred horses of England, which I have heard attributed to the introduction of Arab blood, *via* India, in the early days of Australian settlement. The diminutive horse of Timor is one of the best of his sort. It is not perhaps generally known, that the powerful dray horses of London are thrown up to their great size by the intermixture of pony blood from the male side. It is my opinion that brood mares of the medium sorts as to size and strength would during the greater part of the year draw speedily and well trains of carriages to and fro along the tramways of the domain with manure out, and with soiling food and other produce in, and do much other light husbandry work, without injury either to themselves or to their progeny; and I would suggest, that as all the brood mares need not foal at the same time, it might be well so to regulate the horse-labor of the domain, as that the hulk of it might be done by brood mares, especially when steam-ploughing becomes general. Horses will not, however, in Australian husbandry ever arrive at the degree of importance assumed by their brethren in English husbandry, inasmuch as in addition to oxen, with which alone English horses have hitherto had rivalry in labor, they will in Australia have to

compete with camels, dromedaries, yaks, alpacas, and llamas; and last, not least, with the steam-plough, and various other applications of steam power, the era for which is in the dawn. The Indian market for cavalry horses will always, however, be an important one to Australia, and will induce the impetus to horse-breeding, which is necessary to keep stand arrangements up to any thing like English notions of due importance. If it was not for that circumstance, I should have placed camels before horses in classing the zoologicals of a Victorian domain, it being my opinion, that a few years hence there will be only limited call (save for Asiatic war service) in any of the Australian colonies for horses at prices which will remunerate the breeder.

The Camel family, in which I include as well the camel and the dromedary, as the alpaca and the llama, shall have my fourth place. "The ships of the desert" appear to me to be expressly adapted for Australian husbandry, and it is well that they are comeatable on comparatively easy terms as to purchase, for, judging by the cost of the Victorian railway experiment now in trial, ages must elapse before railway transit can be extensively anticipated, however great may be the yield of nuggets. The formation also of great lengths of ordinary road way is tedious, and if pressed hastily on becomes much more costly than might be the case under leisurely arrangement. It ought to be, therefore, matter of thankfulness, that when under the necessity of adopting the antiquated mode of pack transit, we have the camel tribe at command. In Victoria, which will for ages to come be a country of "rush" and migration, the substitution of camel transit for the slow, cumbrous, and costly bullock-dray system hitherto in use, will be a colonial blessing; and one of its effects will be, to relieve distant interior road boards from much premature expenditure, because laden camels and dromedaries can trot up and down uneven land, and over marshes where it would be impossible to urge onwards a loaded dray. The alpaca and the llama are used as beasts of burden in their native countries, and may be here made to discharge the duties assigned by British husbandry to asses and to ponies, and as they both of them yield food as well as wool, and that too more than sufficient to pay for their care and keep, they are on that account to be preferred to either ponies or asses, which yield labor only. In conveying dairy produce, poultry and game, fruit and vegetables, and other produce, to distant gold-field markets, alpacas and llamas, together with young camels and dromedaries, will be found very serviceable, the alpaca and the llama being reported to be both sure footed and docile. There can be no question as to the eligibility of investment in camel tribe breeding, and the sooner it is set about as a regular branch of Australian husbandry the better.

The Kangaroo family shall have, as of right, my fifth place, and I marvel that the domestication, propagation, and improvement of this interesting family has not already become a department of Australian husbandry. The large kangaroo is a noble animal, and is of more than ordinary value, both as to flesh, fur, and hide, and as it will soon come into payable demand

for British and European parks, and for zoological and other gardens, it is time that this decided staple of Australian produce became duly appreciated as such, and its domestication and propagation were set about systematically. Sound principles of breeding and judicious crossing among existing varieties will probably result in the formation of new varieties, and in the better development of the family. The marsupiates constitute a very interesting group of the animal kingdom, and some of those of America will be found deserving of the thought of the Australian breeder in his persistent development of the whole group, and looking at the easy terms on which Anstralia transferred his vast dominion to Great Britain, I shall propound on behalf of Europe, that a trust to accomplish that development of this, the first in import, of nature's animal gifts to Australia, passed by implication with the transfer; and that that trust attaches on every delegation of self government by the British crown to its Australian colonies. I trust, therefore, that in the zoological establishment intended to be located in the Royal Park of Melbourne, kangaroo domestication and breeding will be paramount objects of early care. I saw at the great English Industrial Exhibition of 1851 a large pig, which had been cured and made into good bacon, without dismemberment, save embowelling; and though a pig is, perhaps, the awkwardest of all animals for such an experiment, the curative artist had overcome his difficulties so well, that I am impressed with the belief, that most of the edible animals of Australia could be so cured. Ingenuity could scarcely devise either an animal or a posture better adapted for preservation entire, as a festival dainty, than a non dismembered kangaroo in a state of rest on his haunches. With the small varieties there would be but little difficulty, and there can be none whatever in curing the haunches and other prime parts in separate joints, and in making preparations of the tail for soup. If therefore John Bull shall really, as Mr. Michie's friend recently suggested, take a liking for kangaroo sausages, (and Melbourne is really predestined to vie with old Bologna in the sausage trade, as Mr. Michie predicts,) there will be, in troth, a new Australian staple in the kangaroo family, both alive and dead. The curative chemistry of the colony at all events ought to be encouraged, and it may be well to import with Aberdeen pickled and preserved fish and flesh, half a dozen professors of the curative art.

The Goat family, and especially the fine haired varieties of Cashmere, Angora, Thibet, and California, appear to me to have claim to my sixth place. I have, however, to testify that the goat of Britain is a mischievous animal in plantations, and among young quickset fences, and that he is under ban in his last strong hold—the mountains, by prohibitory clauses in Welsh leases, wherever improvement and English culture are to be introduced. Perhaps inefficient domestication was to blame for some of this as much as the goat. It may much expedite the introduction of the fine haired varieties, and lead to the general improvement of the goat family, if instead of commerce with ordinary males, the females of the races already in the colony are introduced to males of the more valuable breeds, when those breeds shall have been imported. The milking faculty of the

goat (which may be called a miner's and the poor man's cow) is worthy of thought in its development, and the size of the goat may probably be increased to advantage. I observed when I visited English Brighton many goats employed in drawing the light carriages of invalids and children along the sea beach, a service which they performed with great alacrity and in an admirable manner. I mention the circumstance as a hint in case Victorians, should have occasion to exact similar duty, and especially in case the animal shall by crossing increase in size and strength. My note book records that naturalists have held that goats and sheep will interbreed, and that the progeny will be fruitful, but I do not vouch that fact, and I mention the matter merely as one worthy of inquiry. A combination of hair and wool may be better for some purposes than either material alone; and I am sure that a fat mutton admixture would have improved all the goat's flesh which it has been my lot to taste. The ancient Teeswaters, the Dorsets, or the old Lincoln sheep are what I should first experiment with, if I was induced to make the attempt.

Swine, which transmute refuse of every kind into valuable pork and bacon, are entitled to my seventh place. I like the pigs, both of Victoria and South Australia, but I trust that the fat mania will not be permitted to spoil Victorian pork and bacon for sea use, which ought to be a leading object in the husbandry of a maritime colony. Probably an artificial moderation of temperature will be necessary in hot weather during the curation process, to ensure a first-class article; and if so, that temperature ought to be provided.

The lesser fur-clad, and edible, and useful animals constitute my eighth class, among which those which are indigenous to Australia shall, as of right, have first place. Opossums, wombats, porcupine ant-eaters, and the ornithorhynchus paradoxus, which will all pay for domestication and care, will serve to indicate this class so far as Australians are concerned; and hares, rabbits, and beavers, together with ferrets, genets, and other vermin destroyers, will suffice to indicate the kind of alien immigrants which shall have naturalization in the class; which, when formed and placed under the care of the male juveniles of the domain, will afford them fine scope for their first essays in thought and labor. The English variety of rabbit called the silver grey is to be preferred, because of the greater value of the skin in Chinese estimation; and I may remark, that rabbit warrens will probably profitably pioneer the appropriation of loose sandy districts, by bringing them under ownership, and enriching them with rabbit dung, which is of considerable value as a manure.

The poultry yard of a Victorian domain will be such an important concern, and such an admirable field for feminine care, that I shall constitute it my ninth class, giving, as of right, precedence in place to the emu, the *menura-superba*, and native turkeys, swans, geese, ducks, pheasants, and such other feathered Australians as will submit to the degree of domestication required to pass them within the pale of the vast feathered com-

munties which Victorian poultry yards are predestined to become, when the east and the west, the north and the south shall have sent their delegates to mingle in the monster gabbles of Victorian domains. I was interested, on a visit to English Warwick, with some ducks unusually long in the leg, which attracted my notice, and seemed to be quite at home with other ducks in the mill pond under Warwick Castle. I was told by the miller, that a gentleman curious in such matters had procured the eggs from some place beyond the Cape, and had hatched them under English ducks. Every egg had produced its duck, and those in the mill pond had been sent as a present to Lord Warwick. With China and India so near, and with such facilities as the overland route gives for bringing out the eggs of game and of other birds from England to be hatched here, who will venture to limit the feathered subjects of a thrifty Victorian dame, at the head of a first-class domain poultry yard! The Warwick miller could not tell me whether the duck eggs had been subjected to any process to preserve vitality, and I regret that I was unable to linger so as to pursue inquiry. The case, however, evidences that some feathered introductions may at all events be made in the egg state.

The silk worm, the cochineilla, and the bee, as the nucleus of a municipality of lilliputian industrials, shall form my tenth class, with power to receive such other tiny brotherhoods into membership as may be able to yield commensurate return in the way of product, for their food, care, and cost.

As every grantee of a maximum domain will, as soon as practicable, provide capacious ponds and reservoirs for the purposes of water storage and irrigation, the economy of stocking those ponds and reservoirs with such fish as can be brought into a state of semi-domesticity presents itself to notice. Fish ponds have long been in Europe a branch of rural economy, and several treatises have been written on their management. Change in diet is at times salutary, and as a store of living fish becomes of consequence and value in places remote from the sea coast, and distant from a river, I shall introduce fish as my eleventh class, and instance eels, pike, perch, dace, carp, and tench, the guramier, tortoise, and crayfish, together with such of the fresh water fishes of Australia, and Australasian rivers and lakes, as can be brought to acquiesce in the monotony of pond life, as a fair stock of freshwaters to begin with. If it is true that the flounder and the mullet have acceded to naturalization in fresh water, they may be added. In localities connected with estuaries or with the sea coast, and peradventure also in artificially made saline water ponds, the water collected for grass land irrigation may be made to supplement the fresh water yield by contributions of salt water varieties.

My twelfth will be a miscellaneous class, to consist of antelopes, gazelles, English harts, and other kinds of deer, and of such other domesticated animals as shall be deemed worthy of introduction into Australian husbandry, but which happen to be intelligible for admission into any of the foregoing classes, formed, as is evident, with a view only to profit. The

shepherd's dog, together with hounds and some other dogs, and also the ass, will fall properly into this class, though I do not see opening in Australian husbandry for the services of the ass, because it happens to have nothing but labor to offer, whereas its laboring competitors, the yak, and the llama, &c., offer also food, &c., &c. in addition to labor, and will of course have preference. I may remark, in conclusion, that though I have confined my attention exclusively to such zoologicals as will pay for breeding and feeding, I am, nevertheless, inclined to countenance a given degree of encouragement to the keeping of animals for the objects of science, sport, or curiosity. The English hart is so greatly superior, as an animal of chase, to that cunning poultry thief the fox, that I trust Mister Reynard will never be allowed to become an Australian immigrant, and that, when the last of the dingoes shall have shared the fate of the last English wolf, Australian Nimrods will resuscitate, at the antipodes of England, the sterling old national sport of hart hunting, conjointly with that of African boks, gazelles, and antelopes, and leave the fox to their English cousins, who cannot have Australian choice.

I come now to the supply of food for the many zoological subjects which I am appending to a domain, and to a consideration of my ways and means for their sustenance. Some permanent pasturage and meadowing is essential where much stock is kept, and I think some modern notions on the all-sufficiency of what is called the alternate grass and tillage system, for stock supply, fraught with mischief. In prescribing the seeds to be sown in the fields which I have set apart for permanent grass and herbage, I was determined in the preference which I have given to English varieties, solely because their alimentary properties have been well ascertained; and in my selection of sorts I was guided by the result of my own experience, which has, in that respect, been much more than usually extensive. I am, however, persuaded that in the course of years botanical science will reveal to the Australian husbandman many indigenous grasses and herbage plants worthy of culture and improvement by hybridization, &c.; for I entertain too exalted an opinion of the wisdom and benignity of Providence and of Nature, to suppose that such a vast region as Australia has not plants especially adapted to the peculiarities of its climate; but, until it shall have been ascertained what those plants are, and what effect they will have on animals of European origin, we must be content to walk in the safe path of experience, and avoid labyrinths, unless and until they may be entered without endangering the healthy existence of our flocks and herds.

For the hospital crofts, which I have provided for diseased and weakly animals, producing females, lambing ewes, rearing calves, and ready turn out on occasional purpose, &c., &c., &c., and in which I would erect a cote, where it would do not only for both crofts, but also for the adjoining field, which, by reason of its position, I have called cote paddock. I would, in imitation of medical practice, tempt appetite by the introduction of a few herbaceous dainties beyond what I conceive to be necessary in other cases: the following is the admixture of seeds which I would suggest:—One-eighth white clover (*trifolium repens*), another eighth cow clover (*trifolium pratense*)

perenne, medium variety,) and alsyke (*trifolium hybridum*), combined in equal proportions; another eighth hop trefoil (*trifolium procumbens*), yellow trefoil (*trifolium minus*), lotus major (great birds-foot trefoil), lotus corniculatus, medicago lupulina, creeping vetch (*vicia sepium*), wild thyme, trifolium incarnatum, and any other clovers than those specified, in colonial use, mixed in equal proportions; and another eighth incern, sainfoin, burnet, yarrow, parsley, and plantain, in equal proportions, making the pasturage half herbaceous; another eighth the perennial variety of rye grass called Stickney's (after an Holdenness agriculturist who began its cultivation), which is of surpassing merit, and had the commendation of Sinclair, the coadjutor of Sir Humphrey Davy, in the "*Hortus Gramineus Woburnensis*;" another eighth kangaroo grass and the best of the indigenous grasses and herbaceous plants of Australia, because it will be in these crops that young Australian animals will have their domestication and pasturage; and the remaining two-eighths the twelve English grasses called *anthoxanthum odoratum*, *dactylis glomeratâ*, *phleum pratensis*, *alopecurus pratensis*, *cynosurus cristatus*, *arena pratensis*, the three *festucas*—*ovina*, *pratensis*, and *duriuscula*, and the three *poas*—*pratensis*, *trivialis*, and *nemoralis*, combined in equal proportions, making the pasturage half gramineous. I am aware that some of the herbaceous plants named are not perennials, but, as these crops will be always eaten bare, and be thereby kept from seeding, the biennials and triennials will thereby acquire a considerable degree of longevity, so that when, in the course of nature they do disappear, the white clover and other creepers, together with the grasses of tillering habit of growth which happen to adjoin them, will soon usurp possession of the relinquished ground, and keep up the pasturage. The non perennials are, however, introduced too sparingly to be detrimental to the formation of an early and a well stored pasturage.

For the cow pastures I would suggest two-eighths cow clover, one-eighth alsyke, and one-eighth white clover, incern, sainfoin, burnet, yarrow, and plantain, combined in equal proportions, making them also half herbaceous; another eighth Stickney's rye grass, a sixteenth *dactylis glomeratâ*, another sixteenth *alopecurus pratensis*, *phleum pratensis*, *festuca pratensis*, and *poa pratensis*, in equal proportions, and the remaining two-eighths the seven other English grasses prescribed for the hospital crops. The creeping propensity of white clover will lead to its extension wherever there may be failures, and that circumstance will account for the preponderance which I have given to alsyke and cow clover. Moreover, hungry cows require a better bite than white clover affords.

For the sheep pastures I would suggest three-sixteenths white clover, one-eighth alsyke, a sixteenth cow clover, and an eighth lucern, sainfoin, burnet, yarrow, plantain, medicago lupulina, and hop, and yellow trefoils, in equal proportions, and making them also half herbaceous; another eighth Stickney's rye grass, and the remaining three-eighths the twelve other English grasses prescribed for the hospital crops, in equal proportions.

For the general pastures (i.e. home paddock and cote paddock,) I would suggest one-eighth white clover, one-eighth cow clover, one-eighth alsyke, and one-eighth lucern, sainfoin, burnet, yarrow, plantain, medicago lupu-

lina, and hop and yellow trefoils, in equal proportions, making them also half herbaceous ; one-eighth Stickney's rye grass, another eighth kangaroo grass and the best of the indigenous grasses and herbaceous plants of Australia, and the remaining two-eighths the twelve other English grasses prescribed for the hospital crofts, in equal proportions.

For the clover paddock, I would suggest two-eighths cow clover, two-eighths white clover, two-eighths alsyke, and two-eighths hop trefoil, yellow trefoil, lotus major, lotus corniculatus, creeping vetch, medicago lupulina, lucern, sainfoin, burnet, yarrow, plantain, Stickney's rye grass, and dactylis glomerata, mixed in equal proportions :—an admixture of other plants with the clover making the pasturage more palatable, and, perhaps, adding to its nutritive and salutary properties also.

For the lucern paddock, I would suggest six-eighths lucern, one-eighth cow clover, white clover and alsyke mixed in equal proportions ; and the remaining eighth,—hop trefoil, yellow trefoil, lotus major, lotus corniculatus, creeping vetch, medicago lupulina, sainfoin, burnet, yarrow, plantain, Stickney's rye grass, and dactylis glomerata, mixed in equal proportions.

In regard to the meadow, as there are over a hundred British and European and other perennial grasses and herbaceous plants, worthy of introduction into Australian husbandry, and, as I am persuaded, as I before observed, that many indigenous grasses and herbaceous plants will, in course of years, be found worthy of culture ; I would suggest the carrying of the floating gutters of the meadow, across it from east to west, at equal distances, and so as to divide it, in the first instance, into twenty-six plots of an acre each, which might, by three floating trenches cut at equal distances from north to south, be subdivided, so as to form 104 equal sized plots, by which arrangement that number of distinct varieties might be separately cultivated without confusion, if that number was thought desirable ; and every plot might be seeded too, should there be a demand for seed. Why should Victoria have to send to England or to Scotland for its grasses and herbaceous seeds, save on the first supply and for new varieties, or on change of seed.

The meadow would of course, be formed in the lowest corner of the domain, as the common receptacle of the surplus water from every other part, and the division arrangement, which I have suggested, would test by contrast the comparative value of each plot, all being under similar culture, and would decide also which would pay best for water, if it happened to be scarce. In fixing my proportions of the various plants intended to constitute my pasturage, I have taken the number of seeds, and not either their weight or measure as my criterion, because some seeds are very much more bulky than others, and some again are much heavier than others ; so that neither weight nor measure alone secures satisfactory adjustment. Some years ago when the price of grain was very low in England, and cattle and sheep were paying better than arable culture, I was intrusted with the conversion of extensive tracts of arable land into permanent meadowing and pasturage. The extent of the operation called for great care, and I placed myself in correspondence with Mr. Sinclair, (the coadjutor of Sir Humphrey Davy in their celebrated Bedford experiments, and in the production of the Hortus

Gramineus Wohurnensis), and also with Mr. Stickney, an old Holderness friend (who had written on the subject in the communications to the English Board of Agriculture, and had introduced the perennial variety of rye-grass which bears his name into general husbandry), on several matters of detail, one of which resulted in my adoption of a mode of seed distribution grounded chiefly on weight, but applied also to measure, where I thought that necessary. I caused the seeds of carefully weighed packages of an eighth of an ounce each, of every kind which I was about to sow, to be counted, after which the process of multiplication gave me the number of seeds in a pound, and by keeping a record of every counting I had no difficulty in prescribing either by weight or by measure the seeds for every individual field in any pre-arranged proportions. I found it necessary to sow heavy seeds and light seeds by themselves, which I did by sending a row of sowers one after another with mixed seeds of equal weight, to ensure better distribution, but I made one harrowing cover them all. The operation was very nice, and I therefore awaited the opportunity of a calm moist evening, and used only a light whitethorn hush harrow, followed by a roller; and as grass seeds are hardy, and I invariably adopted autumnal sowing, they soon germinated, and I experienced no difficulty in the humid climate of England, in getting in a few months fair pasturage. I never sanctioned sowing grass seeds for permanent meadows or pastures, along with a grain crop; and I have a record in my note-book, that in the course of years I paid over a thousand pounds for grass and herbage seeds so sown, which indicates that my operations were greatly in advance of mere experiment. I was in the main successful, and though I had reason in some of my first sowings to be dissatisfied with the vitality of some of my costliest seed, I got over that difficulty afterwards by a testing germinating process before sowing; and by holding my seedsmen responsible under their guarantees. It is to be borne in mind that the more deeply-rooting a plant is, in its habit of growth, the greater will be its value in Australian husbandry; and that as Nature, when left to herself, invariably provides an admixture of sorts, to keep up a successional supply in her pastures, for the varying seasons of the year, it will, in the formation of artificial pasturage, be wise to profit by the wisdom of such a considerate provision. More moisture, however, than the climate of Australia yields is essential to good meadowing and pasturage; and unless and until irrigation becomes part and parcel of regular Australian husbandry I cannot venture to predict that aught like the evergreen pasturage of old England will greet the eyes of Australian husbandmen, or gratify the palates of their sheep and cows.

I regard the system of giving succulent herbage to cows and sheep, &c., under cover, to which the term *soiling* has become attached, as a great result in modern husbandry, and as being peculiarly adapted for Australian climates, where night pasturage may be indulged in throughout great part of the year. The feeding of cows with regularity at stated periods, under cover, and in a regulated temperature in well ventilated sheds, and the exercise of driving them to their pasture in an evening after milking, and bringing them home to milk in early morn, cannot be otherwise than beneficial to their

health and a great improvement on the fly-tormenting practice of day pasturage; and it is a great argument in favor of the soiling system, that it is applicable, not only to cows, but also to sheep, horses, camels, and goats. Its economy in food, and the greatness of the additional manure supply, to which its adoption will lead, are both of them important objects; and it is to that additional supply that I look for the share of the homestead manure which will be called for by the special culture department, which it is obvious will yield little manure of its own. Having in an earlier part of this essay, adverted summarily to the cropping of the Victorian course, I shall in this place content myself with the statement, that all the cereals in a green state, the clover and vetch families, all the gramineous and herbaceous plants, and particularly lucern, sainfoin, hurnet, plantain, parsley and yarrow, the tops as well as the roots of potatoes, turnips, beets, chicory, carrots, and parsnips; cabbages, lettuces, celery, rape, and other brassicas; gourds, water-melons, marrows, and pumpkins; pulse and lentil crops (as well green as dried), and maize, millet, buck-wheat, hemp-seed, sorghum, and gramme, &c. (in both states), and also rape seed, cotton seed, and linseed made into cake, and preparations from other oil and fruit refuse, may all be made to supplement that course in soiling supply. The great care of the cultivator will be, so to time the succession of his supplies as to avoid superabundance one month and scarcity another. Of course the due storing of roots and of dried fodder will be a paramount object of care.

Sir John Sinclair, who was attached to the soiling system, stated that one acre of cut clover was equal to two pastured, even of the same crop in the same field; and he instanced a case in which thirty-three cattle were soiled from the 20th of May to the 1st October, on 17½ acres; when it would have taken 50 acres to have pastured them in the field; from which he inferred the saving of land to be, in that case, 32½ acres, being in the approximate ratio of two to one.

Carwen, the English agriculturist, who was the first to practise the soiling system on an extensive scale, published an account of his proceedings, and succeeded in his object of keeping working horses and milking cows, in great measure, on steamed potatoes, supplemented by turnips, rape, cabbages, kohlrabi, and carrots; in some cases, also, steamed. It was the then enormously high price of hay which led him to the system.

The Rev. W. L. Rham, in his Dictionary of the Farm, states that a cow or an ox requires three acres of English grass land for pasturage and hay, for its keep the year round; but that, by raising clover, lucern, sainfoin, tares, and other green crops, three cows could be fed with the produce of one acre, especially if a portion was in turnips or other succulent roots.

The Americans, long ago, adopted soiling in dairy management, using green maize, buck-wheat, oats, and rye; and they also applied the system to sheep. Quincy, one of their senators, who practised soiling on a large scale, enumerates six advantages as resulting from it, viz., the superior condition of the cows, sheep, and cattle, under that management; greater production in milk, improvement in the quantity as well as quality of manure, saving in land, saving in fencing, and saving in food. An experiment is recorded in the American farmer which showed that 17 acres

of land, under the soiling system, had supported as much stock as had previously required 50 acres, which is singularly corroborative of the statement of Sir John Sinclair; for I have ground for believing that the two statements are grounded on separate premises.

Soiling appears to have found its way into English husbandry from the Flemings, who are now fully developing it in connection with their clever liquid manure arrangements. Though it obtained footing in Hertfordshire and Kent, two centuries ago, it is only of late years that it took permanent position in British husbandry, and became an adjunct of stall feeding, which, however, it now leads. It is rapidly gaining ground also on the Continent of Europe, because it is considered peculiarly adapted for warm climates; and if in the climate of England (as I have seen stated), Incarn has risen to the flowering process three or four times in the year, a variety of sainfoin, called the double bearing, has flowered, and even ripened its seed twice in the year, common red clover has, as a rule, flowered twice, and occasionally, even thrice in the year; Italian rye-grass has well ripened two crops of seed in the year, and, when abundantly manured, done even more than that, may we not fairly reckon upon an abundance of food and a great development of the soiling system in the genial climate of Australia Felix, when it shall have the impulsive co-operation of a well organized system of irrigation.

The third, or Victorian special culture branch of Australian husbandry, admits of as much system and regularity in its management as the other two. It is of ample magnitude, and will give an Austral-Oriental import to the whole.

Humboldt has remarked that climate heat is not so dependent on latitude as has been thought, and it is evident to an observant mind that local influences and aspect, as well as latitude, are to be considered in the endeavour to acclimatize new vegetable productions. The isothermal, or line of equal heat which would pass through Australia about latitude 35° , would cross America about 30° , and Europe about 45° . The climate of Australia is therefore better adapted for tropical products in a given latitude than is that of America; and I apprehend that, if acclimating is conducted with care, and comparatively hardy varieties are selected, many tropical products may be reconciled to a North Victorian habitat.

The Colony of Victoria being situate between the parallels of 34° and 40° will, doubtless, produce in perfection most of the staple products of France, Italy, Spain, Greece, and South Europe; of the medium climates of Asia, and especially those of the favoured countries of Persia, Northern India, and China; of

the best regions of America, and especially those of Virginia, Carolina, Georgia, Florida, California, Brazil, and Chili; and also many of the special products of Northern and Southern Africa, and especially of that mother country of culture,—Egypt. It is obvious, therefore, that Australian husbandry will anon embrace the culture of the choicest products of the earth. The banana is reported to have ripened at Adelaide, and I myself, when at Adelaide in 1859, visited the orangery (of several acres) of His Honor Mr. Justice Gwynne, in which trees laden with fruit looked full as hardy and thriving as apple trees in an English orchard. I had thought it advisable, before coming out, to visit the vineyards of France, but I saw none there which surpassed those of South Australia. The Indian shrub Nopal (*cactus opuntia*), which supplies food for the cochineal insect, and the white mulberry, which is the best food for the silkworm, will both of them admit of easy culture in Victoria, so that the production of cochineal and silk will, ere long, be among the objects of Victorian special culture.

The proportionate quantity of Agraria Domain assigned to special culture is 159 acres, being five allotments of 26 acres each, in addition to the homestead and the private road. I thought it desirable to keep the land of each of the three departments from interference with the others; and the following enumeration and classification of the objects intended to fruit the special culture branch will show its scope and its importance as providing abundance of light and healthy out-door employment for the female labor of the domain, and for children, when strong enough, to assist in gathering fruits and produce, and the drying of tea, and making preserves, &c., &c., &c. The numbers on the plan which have reference to this department are 1, 4, 10, 12, 13, 22, and 25.

I assign the special culture allotment numbered 12 to the vineyard, intending that raisin and table grapes and the currant vines of Zante, as well as wine grapes, shall be objects of vineyard culture. The progress in Australian husbandry of this department has been astonishingly rapid; a vineyard of 26 acres is of itself a little heritage, and, if well managed, will be found to be a source of great profit. The fact that the colony has charge of its own

distillery laws and export duties is very encouraging to intending emigrants. The vine is so easily propagated, and comes so soon into profit, and is moreover so comparatively light in its labor demand, that it is in my opinion exactly the thing for the man of slender capital.

I assign the allotment numbered 13 to the orchard and the orangery, intending that English and French apples and pears, for the manufacture of cider and perry; and the production of apples, pears, plums, peaches, apricots, nectarines, cherries, quinces, almonds, figs, loquats, filbert and Spanish nuts, and black mulberries, which are all legitimate objects of a Victorian orchard, shall, together with oranges, citrons, and lemons, and all other fruits adapted to the climate of Victoria and admitting of orchard culture, yield produce in the shape of jams, preserves, dried fruits, and liquors, in productive rivalry with its neighbor the vineyard. I have an impression that such an orchard will be even more profitable than the vineyard, especially if the mining population of the colony shall, like that of Devonshire and Cornwall, take a liking for cider and perry, and if fruit wines and brandies shall come into general consumption. As the tamarind, the date, the chesnut, and the walnut grow to a large size, it may answer a double purpose if they are planted in the pastures as shade and shelter trees, and yield their orchard room to more portable trees. I find in my notebook a statement (on the authority of Widdington, who wrote on the agriculture of Spain) that the chirimoya, a tropical fruit, comes to perfect maturity in the open gardens of Motril, in Spain; a cheering piece of intelligence to the agriculturists of Victoria, for if such a fruit has become naturalized in Spain, it and many other tropicals may be expected to succeed in North Victoria.

I assign the allotment numbered 4 to the following purposes: a tea shrubbery, a coffee plantation, a sugar plantation, and a hop ground, in such proportions as shall be found most in accordance with the views of the cultivator. I was much pleased with the improved appearance which the climate of France had given to some English hops in the neighborhood of Fontainebleau, and I am impressed with the belief that Victorian hop grounds will surpass in yield and profit those of England. Relief from the heavy

English duty is a direct premium to the Victorian grower. Coffee and sugar may, perhaps, have to be relinquished in South Victoria, except in favorable locations, but there can be no question as to tea and hops; probably coffee and sugar will in the sequel become staple products of North Victoria, and hops and tea of the southern districts.

On revising for the press, I embrace the opportunity of introducing the following additional remarks on the culture of this allotment.

Coffee is very susceptible of frost, and must, in South Victoria, have assigned to it very sheltered and choice position. Brazil at present produces half the coffee grown. The consumption of coffee is on the increase, and if its cultivation gets footing in Victorian husbandry, it will, I apprehend, be as a North Victorian product; though, as it is grown in Spain, it ought to be tried, on a small scale, in favored localities of South Victoria.

Tea may be successfully grown in either division of Victoria, and it will be advisable to have a small plantation on every domain, because it is not only a portable article, but it is also one which does not spoil should the market happen to be otherwise than immediate. I am, however, impressed with the notion that very extensive tea culture is not advisable in Australia, because when the Chinese and the Japanese become sensible enough to see their own interests, they will extend the production of their own peculiar commodity; and there being no doubt of their ability to tea the world, and to produce tea at less cost (by reason of their command of cheap labor) than Australians can at all events for many years to come; and as I have an impression also, that by the time Australians are in a condition to compete with China and Japan, in the European market, they will find the true China plant universally introduced into European shrubberies and pleasure grounds, as a half useful and half ornamental shrub wherever it will thrive, a circumstance which will help to keep the price of tea low.

Saccharine produce has become so essential an article of civilized consumption, that every known mode of *Sugar culture* ought to have trial in Victoria. Hitherto the cane of the east, the maple of the west, and the beet-root of Europe have been the plants chiefly cultivated for sugar; but I apprehend the vegetable world has other plants to offer for sugar production, and that Australian husbandry will have a wide saccharine range. It ought to be cheering to Australians to know that in the West Indies, which have long been called par excellence the sugar colonies, the cultivation of sugar was an introduction by the Spaniards from Europe; though there is ground for supposing that some plant which produced sugar was there indigenous.

The sugar-cane is propagated by laying cuttings or slips of the cane horizontally. There are four varieties cultivated in America, viz., the African, the Otaheite, the West Indian, and the rihband cane. The Otaheite grows luxuriantly, and ripens earlier than the West Indian, but it does not contain so much saccharine matter as the other kinds. The rihband cane is a new variety. It abounds in saccharine juice, and does not require so

long a season for ripening as the other kinds, and it admits of American cultivation two degrees further north than any other kind. The sugar-cane is a comparatively hardy plant, and is cultivated much in the same way as maize, which it resembles when growing. The abundance of the crop depends upon the number of joints that ripen before the frost, so as to allow the saccharine juice to granulate to sugar. A slight frost favors the fermentation which is necessary to the formation of sugar from the sap, though a severe frost destroys the vegetation of the cane. The crop when growing has a beautiful appearance. The sap is so rich in the stalk of the cane as to have almost the consistence of syrup, and sugar exists there as nearly in a complete state as it can be in solution. An acre properly managed will yield a hogshead of 1200 pounds. A sugar establishment is necessarily expensive, by reason of its need of houses and mills where the plantation is large. It has, however, been found that sugar can be grown profitably on a small scale, and without extraordinary capital, and I have therefore determined on including its production, to a given extent, as part of domain culture; leaving it to capitalists to establish an extensive plantation system conjointly with the production of cotton in large areas.

The pine-apple, to which I shall afterwards advert, abounds in saccharine matter, of fine aroma, which would, I apprehend, yield much more sugar than the best French beet. Some attention is due, in Australian husbandry, to the saccharine secretion known as Australian manna, yielded by the *encalyptus viminalis*, and also to the exudation, resembling raw sugar, which occasionally incrusts the bark of the *myoporum platycarpum*. I suspect, in regard to the pine-apple, that it will acquire an *ad valorem* value of its own greatly above a mere sugar price. Sugar succeeds best with a mean temperature of 77° , but it may be cultivated with advantage when the mean is not under 67° . No product, however, makes so grateful a return for heat as saccharine matter, in whatever shape it is produced. The sorghum *saccharatum* is sufficiently hardy to thrive in South Victoria, and as it yields both sugar and cattle food, it is in consequence a very valuable product. Four centuries ago sugar was only used as a medicine, and could only be purchased by the ounce from an apothecary; whereas in the year 1828 the production was 441,300 tons, of which nearly half was the growth of the British West Indies alone; and that production had in the twenty-two years which elapsed between the years 1828 and 1850, augmented so as to yield, for the latter year, the almost trebled quantity of 1,243,000 tons. Tea, and some other oriental productions may, in the course of years, be superseded in use by some other product, or become of limited demand; but saccharine matter is so essential in every department of domestic economy, and its refuse is so valuable for the feeding of cattle, that it is sure to be a staple product wherever soil and climate are congenial to its growth. I am impressed with the belief that if proper care is evinced in the selection of adapted localities, and they are prepared by skilful drainage and subsoiling operations, and are accompanied by irrigation so as to urge on vegetation at critical stages of growth, there will be found a sufficiency of sunshine, at all events in a North Victorian climate, not only for the profitable cultivation of cane-sugar, but also for that of many tropical and sub-tropical pro-

ductions on which Victorian cultivators have not as yet reckoned. Cane-sugar will, I apprehend, be most profitably cultivated in plantations of a square mile each, in alternation with cotton plantations of a like extent, as outlying parts of domain management, in cases where super energy and capital happen to lead in that direction.

Hops, as a Victorian product, stand very high in my estimation. The soil and the climate of South Victoria are so admirably adapted for the hop, that the sooner it is introduced into Victorian husbandry the better. Frost, the arch-enemy of the English hop, is not severe enough in Victoria to do harm; and the only adverse influence of which I am apprehensive is atmospherical turmoil. I have however placed the hop plantation on the east side of the domain, for the purpose of being as well screened as may be from hot winds and their devastating dusts, and it must have especial screening on its west and north sides—perhaps the young larches, ashes, and oaks, to which I shall advert as wanted for hop-poles, cannot be better placed than as a plantation screen for the hops which they are predestined afterwards to uphold. I have to observe that though the hop was indigenous in England, the cultivated variety was probably an introduction from the Netherlands, for the name is of Dutch origin. Strong cloth has been manufactured from the fibres of the hop vine, and in spring time country people, in some hop growing districts, dress young huds of the hop in the manner of asparagus, and consider them an agreeable vegetable. These circumstances enhance the value of the plant, and as the colony has, as I have before remarked, the control of its own excise duties, it will be in the power of its legislature to confer on its hop grower the great boon of exemption from an onerous tax, which amounts to £17 12s. 9½d. per ton.

The four foregoing products, of coffee, tea, sugar, and hops, will well occupy the special culture allotment, numbered 4. If the domain is located in South Victoria I should apportion the cropping thus:—hops, twenty acres; tea, three acres; sorghum and other cane-sugar, one acre; coffee, half an acre; hop pole screen plantation, one acre; and a row of sugar maples, within the boundary avenue, half an acre. But if the domain is located north of the 37th parallel, I should then apportion the cropping of the allotment thus:—cane-sugar, twenty acres; coffee, four acres; tea, one acre; and hops, one acre.

I assign the allotment numbered 1 for groves—of the nopal cactus, as cochineal food; of olives and other oil-producing shrubs and trees; of pepper vines; of carob trees; of indigenous trees and shrubs found worthy of culture, either as commercial products or for economical use, as, for instance, the Australian india-rubber tree and the cabbage palm; of groves of senna trees, camphor trees, tallow trees, American india-rubber trees; of all the medicinal shrubs and trees which will pay for cultivation; and of cork oaks, and the best wood for cooperage use. It was my intention to have enumerated several other trees and shrubs which

yield produce of great value, and which I think will thrive in Victoria; but as this is an essay only, and not a treatise, and as I have instanced sufficient to show the class of products assigned to this allotment, and to indicate the range of the special culture department, I shall for the present forego that enumeration.

On revising for the press I have to add, that the *olive*, to which I shall in South Victorian domains appropriate ten acres of the special culture allotment numbered 1, (though in those of North Victoria I shall only appropriate five acres, because I think northern sunshine may be more profitably applied on tree and shrub products which cannot be so well ripened in South Victoria) is so truly a warm climate essential, and has been so long a favorite and a paying product in Italian, Spanish, and French husbandry, that it has, in my estimation, a right to proportionate position in that of Australia. In addition to the products before mentioned I may instance various species of cotton which reach tree dignity, and are in consequence to be cultivated as perennials, as proper to have growing space in this allotment, as also white mulberry trees as silkworm food, in case the private road of the domain shall be insufficient for the supply, or other trees are preferred as vine supporters.

There being many valuable products of field culture which cannot be taken in an annual rotation, because they would stop the onward move of the course, I assign the special culture allotment, numbered 22, for such products. The pine apple, for instance, which in a genial climate requires only the simple culture of a Swede turnip, and propagates itself profitably for ten years by offsets, is a crop in point. For its abundance of saccharine matter and the flavor of its fruit, and for the fibre of its leaves, which, in China, is manufactured into cloth, the pine apple is a very valuable product, and deserves the early attention of the Australian cultivator as a field crop. It is hardier than is generally supposed. The varieties of the onion which have the faculty of offset reproduction, and such other edibles as have that faculty—biennials, triennials, and sub-perennials deemed sufficiently important for occasional culture; madder and cassava, which each require three years for profitable cropping; the dye plants, saffron, weld, woad, and indigo; poppies for opium, tobacco, rhubarb, arrowroot, candamon, liquorice, and ginger; anise, coriander, caraway, and such other seeds as may be in commercial request; lavender, burnet, sainfoin, New Zealand flax and other textiles, and also cotton of sub-perennial habits

of growth, and teazles, all occur to me as deserving admission into this allotment, in which they may be indulged in a little rotatory cycle among themselves, and have the advantage of change of ground without interfering with the great eight years' course of the domain.

The private road will, in fact, become a grove of white mulberries as silk-worm food, and their supported vines will profitably supplement the vineyard yield.

A garden of six acres will form an important part of the homestead, and as variation in aspect may be of great service in the acclimating of new introductions, I shall suggest the placing of the garden in borders round the homestead, as I have marked on the plan; and because the introduction of warm-climate products will, in Australia, exceed in number and importance other garden products and objects, I have assigned greater width to the northern border on that account. Every intelligent agriculturist is also a horticulturist; and it will be highly commendable to endeavor the union of the two departments of culture in the Australian colonies. Goody Hortulana is a fitting spouse for a Victorian Adam, but I must caution the stripling against the blandishments of a syren who delights in raree shows and fetes, wastes time and money in showy trivialities, and assumes occasionally in placards and newspapers the name of a matron of sterling dignity to which the bedizened syren has no pretence. I may with propriety designate not only the garden management of the homestead, but also the management of the whole 150 acres assigned to the special-culture department of the domain, as a system of horticulture united to the agriculture of Victoria.

On revising for the press in June, 1861, I avail myself of the opportunity to introduce a few remarks on the culture and management of *timber trees*, which, in consequence of their having been long recognized as a branch of British husbandry, and timber products being of great importance in commercial communities, fall properly into the special culture department of my system; and this I do willingly, because I hold it to be the duty as well as the interest of the owner of a domain to keep up a supply of timber proportionate to the extent of that domain, and because also, as timber requires many years for maturity, and great mischief to the community might ensue if its growth was neglected. I have also to urge that in the case of Australian grantees, I consider participation in the supply of timber, growing in a Colony when it became a British possession, as

having created in consideration of value received a trust for posterity to keep up that supply; and in doing so I shall advise the intermixture of British and European, Asiatic, Australasian, African, and American trees, among the best of those which happen to be indigenous to Australia. As a Victorian domain of 640 acres is a very different thing from a little English farm, and as the circumstances of the two countries are so contrariwise affected as to atmospherical condition, I shall not hesitate to advise the planting of the four miles of the boundary fence of the domain with what in England would be called hedge-row timber. Few Englishmen will deny that the hedge-row trees of England have in the main added much to its picturesque beauty, and to the charm of English scenery; though it must be admitted that hedge-row trees in England are in many cases in excess, and in some very detrimental to the interests of rent paying tenants. The climate of England, moreover, is moist, and the intervention therefore of thickly timbered hedge-rows round small inclosures interrupts that free circulation of air which is absolutely necessary to dry a saturated soil in a country where the evaporative process is sluggish in the extreme; but in Australia the climate is so dry that that process is faultily quick, and in nine cases out of ten requires counteraction; moreover, as it is likely that for generations to come the owner and the occupant of a domain will be the same personage, an English tenant's case of hardship will not apply. The shade resulting from avenues of forest trees along road sides will be very agreeable to travellers, and will not only act beneficially on the climate by inducing moisture and atmospherical reciprocation in the interchange of oxygen for nitrogen, but it will screen the interior of the domain from much of the atmospherical turmoil of the hot winds and their damaging dusts, evils to which the Australian colonies are liable. Timbered land, and especially that which abounds in deciduous and large leaved trees, by attracting and condensing moisture from the atmosphere in warm weather exercises a beneficial effect in its locality, it being an ascertained fact that extensive forests influence the descent of rain by their attractive power on passing clouds, and of course a well timbered domain will to a given extent exercise a similar influence; and considering also the reciprocal benefit of salubrity in the atmosphere derivable from a commingling of animal and vegetable respiration in a warm climate, it is obvious that the production of timber should be encouraged by every well organized community and form part of its husbandry, even apart from questions of profit and utility. The Americans are beginning to find out that they have been too lavish of their wood, and that timbered land is in some positions of greater value than that which has been cleared at great cost, and that they have moreover done climate mischief in some localities. Plantations of larch, ash, and oak, which in a young state have been found to answer in England better than others for hop poles, and I have no doubt will answer equally well as supporters of vines and of other tendril plants grown in Australia; may have an acre plot of the special culture allotment numbered 4 assigned to them, where they will be near their place of use. The mountain ash to which the late Mr. Wedgwood, of Maer, son of the great potter, called my attention, as the best of all English woodland produce for pottery

crates, happens to be also well adapted for harrel hoops, and as I happen in consequence of his advice to have planted it extensively in some plantations which I made thirty years ago, in the neighborhood of the Staffordshire potteries, I can bear testimony to the great profit at which it speedily arrived, to its beauty and use as ornamental underwood in game preserves, and to the supply of winter food which its berries yielded to several valuable English birds, which will probably ere long yield to Australians the tribute of song in exchange for an English diet. As pottery ware and even porcelain works of art will in due time become Australian manufactures as a consequence of the fine quality of Australian clay, a matter which was tested by the elder Wedgwood, in the medallion, of which an engraving is given on the title page of Governor Phillip's voyage to Botany Bay, published in 1790, about which Mr. Wedgwood, the son, on presenting me with a medallion portrait of his father, made from the same clay, told me that his father had said that he had never seen any article of China manufacture which equalled as to material the Botany Bay clay, and which he therefore predicted would become a valuable import from the Colony. Though it may be long before the master mind of a Victorian Wedgwood shall Prometheus like breathe artistic life into Victorian clay, and send it to vie with the art creations of England, Sevres, and Dresden, &c., it may be well to be providing crate wood and harrel hoops, so that no inconvenience may be felt when those articles come into actual demand, and that is why I have gone out of my way to mention the medallions and to advise the planting of mountain ash as a useful tree. Planted half a chain asunder, the boundary fences will afford space for 640 trees, and I would specially instance as worthy of place among them the blue gum of the colony, the cork oak, the English ship building oaks, and such of the oaks of America as bear the best edible acorns, or are the best adapted for ship building, the red cedar, and the Kauri pine of East Australia, the Norfolk Island and New Zealand pines, and the best of the pine family generally; together with a selection from such of the timber trees as well of Australia as of other countries, as are suitable for a protecting screen against the hot winds, in order to combine protection with ornament and profit. Many ashes and mountain ashes, oaks of the lesser varieties, limes, larches, elms, and other useful trees, and especially such as are best adapted for casks and cooperage use, which are likely hereafter to be in great demand, may be planted at the distance of a chain from each other along the west fences, of numbers 8, 9, 14, 16, 17, and 22, as hedge-row trees, where they will be productive of good by yielding shade, as the sun happens to be east or west of the pastures; the north and east fences of number 19 may be devoted to New Zealand flax, and to osiers and willows, &c., which delight in moisture and will pay well for growing.

Shade and shelter trees dispersed over the range of pasture lands, after the rate of a tree per acre, will give to them a park-like appearance, and will aid materially in checking evaporation. Trees which answer two purposes will of course be preferred, and I would instance tamarinds, date palms, cabbage palms, milk trees, bread fruit trees, cocoa nut palms, cacao nut trees, cashew nuts, walnuts, and chesnuts, Peruvian bark, and service

trees, the bombax ceiba, alluded to in cotton culture, cedars, horse chesnuts, locust trees, beeches, Chili pines, Norfolk Island pines, Weymouth pines, silver fir, and oriental and occidental planes as particularly worthy of place in this parkish district; and of course if there should happen to be any indigenous trees or promising saplings growing on it they will be allowed to remain, though I contemplate the complete clearance of timber from the arable land, and from that assigned to the special culture department. I may remark, that in my annual visits to London for many years, I noticed that planes throve the best of any of the trees planted in the city squares and gardens, and seemed to relish their position. I never heard this accounted for, but the fact is certain; and after it had attracted my notice I made a point of examining every planted square I fell in with, whether it was at the west end, the east end, or on the Surrey side of the city, and I invariably found planes to be the most thriving of the trees, and next to them their kindred tree, the sycamore. I mention the circumstance as a hint to Australian citizens, that both varieties of the plane appear from that peculiarity to be proper for trial in their city squares, avenues, and pleasure grounds; both have the merit of being umbrageous, which is a greater object in Australian cities than in London. Limes are the best of all English trees for avenues, and I used to be delighted when in England at the immense number of bees which at sunrise in summer were always findable gathering boney from the opening flowers of the lime; where therefore bees are kept lime trees have an additional value.

The acclimating of plants and the introduction of new varieties are so important in the infantine state of Australian husbandry, that I deem the subject worthy of a few special remarks, or rather of a series of extracts; for I shall, on these subjects, prefer presenting the observations of others rather than my own, because I am myself partial to fountain-head authority in experimental matters.

The acclimating pliability of nature is well illustrated by Dr. Thomson, of Edinburgh, in his treatise on brewing and distillation, by the remark that the cuticle of Norfolk barley is thinner than that of East Lothian barley, but that when Norfolk barley is sown in Scotland for several successive years its cuticle, in consequence, becomes thicker than it was at its introduction.

Phillips, in his History of Cultivated Vegetables, makes this pertinent observation: "It is worthy of remark that two vegetables of so much consequence in the commerce of Jamaica as the coffee tree and the sugar cane should have found their way to that hot climate through the temperate zone of Europe, where they could never have arrived at perfection. The coffee tree was planted at Fulham, in Middlesex, fourteen years before it was known in Jamaica; and the sugar cane was planted in England fifty years previously to its being cultivated in that island, which may now be justly styled the London sugar and coffee garden."

The celebrated Dr. Priestley, in a letter to Sir John Sinclair, as president

of the English Board of Agriculture, written in 1797, and published in the first volume of the communications to that board, thus speaks of Mr. Joseph Cooper, an American farmer, of the neighborhood of Philadelphia, who may be cited as the type of a class of men much wanted in Australia, in the present stage of its husbandry: "He thought," said Priestley, "philosophically on his subject, and had had extraordinary success in a variety of plans which were then wholly new, and which promised to be of great benefit to his country and the world."

The doctor's letter is not a long one, and as it gives us a glance at American culture a century ago, when it was but little in advance of that which now obtains in Australia, I shall introduce more of it than I at first intended, because of its thoughtful good sense and its exemplifying my belief that thoughtful heads will be a greater acquisition to Australia than even horny hands, notwithstanding the premium price which the latter appear inclined to forestall. The observations of Mr. Cooper are, in fact, a little mannal in their way; and though I do not subscribe without some reservation to all his conclusions, and think that he carries his theory in regard to change of seed and of plants beyond a judicious verge, there is nevertheless much to the point in all his observations.

"I have," writes Priestley, "Mr. Cooper's leave to communicate to you his observations and experiments relating to an opinion and practice which has prevailed, I believe universally, but which he is satisfied is ill founded. Plants, it is said, will degenerate unless the soil in which they grow be changed. It is therefore thought to be necessary from time to time to get fresh seeds and roots, &c. from distant places. Mr. Cooper, on the contrary, has for many years been in the habit of selecting the best seeds and roots of his own; and though he has continually sown and planted them in the same soil, every article of his produce is greatly superior to those of any other person who supplies this market, and they seem to be still in a state of improvement. This, without his knowing it, is the very same plan that was adopted by Mr. Bakewell, in England, with respect to animals. He kept improving his breeds by only coupling those in which the properties he wished to produce were the most conspicuous, without any regard to consanguinity, or to any other circumstance whatever.

"Mr. Cooper was led," adds Priestley, "to his present practice, which he began more than forty years ago, by observing that vegetables of all kinds were very subject to change with respect to their time of coming to maturity, and other properties, but that the best seeds never failed to produce the best plants. Among a great number of experiments he particularly mentions the following:—

"About the year 1746, his father procured seeds of the long watery squash, and though they have been used on the farm ever since that time, without any change, they are at this time better than they were at the first.

"His early peas were procured from London in the year 1756; and though they have been planted on the same place every season, they have been so far from degenerating that they are preferable to what they were then. The seeds of his asparagus he had from New York in 1752, and

though they have been treated in the same manner, the plants are greatly improved.

"It is more particularly complained, that potatoes degenerate when they are planted from the same roots in the same place. At this Mr. Cooper says he does not wonder, when it is customary with farmers to use the best, and plant from the refuse; whereas, having observed that some of his plants produced potatoes that were larger, better shaped, and in greater abundance than others, he took his seed from them only; and the next season he found that the produce was of a quality superior to any that he had ever had before. This practice he still continues, and finds that he is abundantly rewarded for his trouble.

"Mr. Cooper is also careful to sow the plants from which he raises his seed at a considerable distance from any others. Thus, when his radishes are fit for use, he takes ten or twelve that he most approves, and plants them at least one hundred yards from others that blossom at the same time. In the same manner he treats all his other plants, varying the circumstances according to their nature.

"About the year 1772, a friend of his sent him a few grains of a small kind of Indian corn, not larger than goose shot, which produced from eight to ten ears on a stalk. They were also small, and he found that few of them ripened before the frost. Some of the largest and earliest of these he saved, and planting them between rows of a larger and earlier kind, the produce was much improved. He then planted from those that had produced the greatest number of the largest ears, and that were the first ripe; and the next season the produce, with respect to quality and quantity, was preferable to any that he had ever planted before. From this corn he has continued to plant ever since, selecting his seed in the following manner:—

"When the first ears are ripe enough for seed, he gathers a sufficient quantity for early corn, or for replanting, and at the time that he wishes his corn to be generally ripe, he gathers a sufficient quantity for the next year's planting; having particular care to take it from stalks that are large at the bottom, of a regular taper, not very tall, the ears set low, and containing the greatest number of good sizable ears, and of the best quality; these he dries quickly, and from them he plants his main crop; and if any hills be missing, he replants from the seeds that were first gathered, which he says will cause the crops to ripen more regularly than they commonly do, and which is of great advantage. This method he has practised many years, and he is satisfied that it has been the means of increasing the quantity and improving the quality of his crops beyond what any person who had not tried the experiment could imagine.

"Farmers differ much with respect to the distance at which they plant their corn, and the number of grains they put in a hill. Different soils, Mr. Cooper observes, may require different practices in both these respects; but in every kind of soil that he has tried, he finds that planting the rows six feet asunder each way, as nearly at right angles as may be, and leaving not more than four stalks in a hill, produces the best crop. The common method of saving seed corn, by taking the ears from the heap, is attended, he says, with two disadvantages; one is the taking the largest ears, of

which in general only one grows on a stalk, which lessens the produce; and the other is taking ears that ripen at different times.

"For many years Mr. Cooper renewed all the seed of his winter grain from a single plant, which he had observed to be more productive, and of a better quality than the rest, which he is satisfied has been of great use. And he is of opinion, that all kinds of garden vegetables may be improved by the methods described above, particular care being taken that different kinds of the same vegetables do not bloom at the same time near together, since by this means they injure one another.

"It is alleged, that foreign flax-seed produces the best flax in Ireland; but Mr. Cooper says, that when it is considered that only the hark of the plant is used, and that this is in perfection before the seed is ripe, it will appear that his hypothesis is not affected by it.

"Mr. Cooper had the following instance of the naturalization of a plant in a different climate:—He had some water-melon seed sent to him from Georgia, which he was informed was of a peculiarly good quality; knowing that seeds from vegetables which grow in a hot climate require a longer summer than that of Pennsylvania, he gave them the most favorable situation that he had, and used glasses to forward their growth, and yet few of them ripened well. But finding them to be of an excellent quality, he saved the seeds of those that ripened the first; and by continuing this practice five or six years, they came to ripen as early as any that he ever had."

We have now the deductions of the great vegetable physiologist, Thomas Andrew Knight, for our guidance; and I was so much struck with the harmony between the "thought" of Cooper and the "science" of Knight, as exhibited in the foregoing quotation, and in that which I am about to extract from Knight, that I thought it desirable to introduce both, as corroborative of each other on a subject of so much importance in the present stage of the agriculture and horticulture of Australia.

"Nature," writes Knight, in a paper read before the Horticultural Society of England, in 1806, "has given to man the means of acquiring those things which constitute the comforts and luxuries of civilized life, though not the things themselves; it has placed the raw material within his reach; but has left the preparation and improvement of it to his own skill and industry. Every plant and animal, adapted to his service, is made susceptible of endless changes, and, as far as relates to his use, of almost endless improvement. Variation is the constant attendant on cultivation, both in the animal and vegetable world; and in each the offspring are constantly seen, in a greater or less degree, to inherit the character of the parents from which they spring.

"No experienced gardener can be ignorant that every species of fruit acquires its greatest state of perfection in some peculiar soils and situations, and under some peculiar mode of culture: the selection of a proper soil and situation must therefore be the first object of the improver's pursuit; and nothing should be neglected which can add to the size, or improve the flavor of the fruit from which it is intended to propagate. Due attention to these

points will in almost all cases be found to comprehend all that is necessary to insure the introduction of new varieties of fruit, of equal merit with those from which they spring; but the improver, who has to adapt his productions to the cold and unsteady climate of Britain, has still many difficulties to contend with; he has to combine hardiness, energy of character, and early maturity, with the improvements of high cultivation. Nature has, however, in some measure pointed out the path he is to pursue; and, if it be followed with patience and industry, no obstacles will be found, which may not be either removed, or passed over.

"If two plants of the vine or other tree of similar habits, or even if obtained from cuttings of the same tree, were placed to vegetate, during several successive seasons, in very different climates; if the one were planted on the banks of the Rhine, and the other on those of the Nile, each would adapt its habits to the climate in which it were placed; and if both were subsequently brought, in early spring, into a climate similar to that of Italy, the plant which had adapted its habits to a cold climate would instantly vegetate, whilst the other would remain perfectly torpid. Precisely the same thing occurs in the hot-houses of this country, where a plant accustomed to the temperature of the open air will vegetate strongly in December, whilst another plant of the same species, and sprung from a cutting of the same original stock, but habituated to the temperature of a stove, remains apparently lifeless. It appears, therefore, that the powers of vegetable life, in plants habituated to cold climates, are more easily brought into action than in those of hot climates; or, in other words, that the plants of cold climates are most excitable: and as every quality in plants becomes hereditary, when the causes which first gave existence to those qualities continue to operate, it follows that their seedling offspring have a constant tendency to adapt their habits to any climate in which art or accident places them.

"But the influence of climate on the habits of plants will depend less on the aggregate quantity of heat in each climate, than on the distribution of it in the different seasons of the year. The aggregate temperature of England, and of those parts of the Russian Empire that are under the same parallels of latitude, probably does not differ very considerably; but, in the latter, the summers are extremely hot, and the winters intensely cold; and the changes of temperature between the different seasons are sudden and violent. In the spring great degrees of heat suddenly operate on plants which have been long exposed to intense cold, and in which excitability has accumulated during a long period of almost total inaction: and the progress of vegetation is in consequence extremely rapid. In the climate of England the spring, on the contrary, advances with slow and irregular steps, and only very moderate and slowly-increasing degrees of heat act on plants in which the powers of life have scarcely in any period of the preceding winter been totally inactive. The *cra* is a native of both countries, and has adapted alike its habits to both; the Siberian variety introduced into the climate of England retains its habits, expands its leaves, and blossoms on the first approach of spring, and vegetates strongly in the same temperature in which the native *cra* scarcely shows signs of life; and its fruit acquires

a degree of maturity, even in the early part of an unfavorable season, which our native crab is rarely or never seen to attain.

" Similar causes are productive of similar effects on the habits of cultivated annual plants ; but these appear most readily to acquire habits of maturity in warm climates ; for it is in the power of the cultivator to commit his seeds to the earth at any season ; and the progress of the plants towards maturity will be most rapid where the climate and soil are most warm. Thus, the harley grown on sandy soils, in the warmest parts of England, is always found by the Scotch farmer, when introduced into his country, to ripen on his cold hills earlier than his crops of the same kind do, when he uses the seeds of plants, which have passed through several successive generations in his colder climate ; and in my own experience, I have found that the crops of wheat on some very high and cold ground, which I cultivate, ripen much earlier when I obtain my seed-corn from a very warm district and gravelly soil, which lies a few miles distant, than when I employ the seeds of the vicinity.

" The value, to the gardener, of an early crop, has attracted his attention to the propagation and culture of the earliest varieties of many species of our esculent plants ; but in the improvement of these he is more often indebted to accident than to any plan of systematic culture ; and contents himself with merely selecting and propagating from the plant of the earliest habits which accident throws in his way, without inquiring from what causes those habits have arisen : and few efforts have been made to bring into existence better varieties of those fruits which are not generally propagated from seeds, and which, when so propagated, of necessity exercise, during many years, the patience of the cultivator before he can hope to see the fruits of his labor.

" The attempts which I have made to produce early varieties of fruit are, I believe, all that have yet been made ; and though the result of them is by no means sufficiently decisive to prove the truth of the hypothesis I am endeavoring to establish, or the eligibility of the practice I have adopted, it is amply sufficient to encourage future experiment.

" The first species of fruit which was subjected to experiment by me was the apple ; some young trees of those varieties of this fruit, from which I wished to propagate, were trained to a south wall, till they produced buds which contained blossoms. Their branches were then, in the succeeding winter, detached from the wall, and removed to as great a distance from it as the pliability of their stems would permit, and in this situation they remained till their blossoms were so far advanced in the succeeding spring as to be in some danger of injury from frost. The branches were then trained to the wall, where every blossom I suffered to remain soon expanded and produced fruit. This attained in a few months the most perfect state of maturity ; and the seeds afforded plants, which have ripened their fruit very considerably earlier than other trees, which I raised at the same time, from seeds of the same fruit, which had grown in the orchard. *In this experiment the fecundation of the blossoms of each variety was produced by the farina of another kind, from which process, I think, I obtained in this and many similar experiments an increased vigor and luxuriance of growth ; but I have no reasons*

whatever to think that plants thus generated ripen their fruit earlier than others which are obtained by the common methods of culture. I must, therefore, attribute the early maturity of those I have described to the other peculiar circumstances under which the seeds and fruit ripened from which they sprang.

"I obtained, by the same mode of culture, many new varieties, which are the offspring of the Siberian crab and the richest of our apples, with the intention of affording fruits for the press, which might ripen well in cold and exposed situations. The plants thus produced seem perfectly well calculated in every respect to answer the object of the experiment, and possess an extraordinary hardiness and luxuriance of growth. The annual shoots of some of them, from newly grafted trees in my nursery, the soil of which is by no means rich, exceeded six feet and a half in height in the last season; and their blossoms seem capable of bearing extremely unfavorable weather without injury. *In all the preceding experiments some of the new varieties inherited the character of the male, and others of the female parent in the greatest degree; and of some varieties of fruit (particularly the golden pippin) I obtained a better copy by introducing the farina into the blossom of another apple, than by sowing their own seeds; I sent a new variety (the Downton pippin) which was thus obtained from the farina of the golden pippin, to the Horticultural Society last year; but those specimens afforded but a very unfavorable sample of it, for the season, and the situation in which the fruit ripened, were very cold, and almost every leaf of the trees had been eaten off by insects. In a favorable season and situation it will, I believe, be found little, if at all, inferior to the golden pippin, when first taken from the tree; but it is a good deal earlier, and probably cannot be preserved so long.*

"I proceed to experiments on the grape, which, though less successful than those on the apple in the production of good varieties, are not less favorable to the preceding conclusions. A vinery in which no fires are made during the winter affords to the vine a climate similar to that which the southern parts of Siberia afford to the apple or crab-tree: in it a similarly extensive variation of temperature takes place, and the sudden transition from great comparative cold to excessive heat is productive of the same rapid progress in the growth of the plants, and advancement of the fruit to maturity. My first attempt was to combine the hardiness of the blossom of the black cluster, or Burgundy grape, with the large berry and early maturity of the true sweetwater. The seedling plants produced fruit in my vinery at three or four years old, and the fruit of some of them was very early; but the bunches were short and ill-formed, and the berries much smaller than those of the sweetwater, and the blossoms did not set by any means so well as I had hoped.

"Substituting the white chasselas for the sweetwater, I obtained several varieties whose blossoms appear perfectly hardy, and capable of setting well in the open air; and the fruit of some of them is ripening a good deal earlier in the present year than that of either of the parent plants. The berries, however, are smaller than those of the chasselas, and with less tender and delicate skins; and, though not without considerable merits for the dessert, they are generally best calculated for the press: for the latter purpose, in a

cold climate, I am confident that one or two of them possess very great excellence. I sent a bunch of one of those varieties to the Horticultural Society in the last autumn, and I propose to send two or three others in the present year.

"I have subsequently obtained plants from the white chasselas and sweet-water, whose appearance is much more promising; and the earliest variety of the grape I have ever yet seen sprang from a seed of the sweetwater and the farina of the red frontignac. This is also a very fine grape, resembling the frontignac in color and the form of the bunch; but I fear its blossoms will prove too tender to succeed in the open air in this country; a single bunch, consisting of a few berries, is, however, all that has yet existed of this kind. The present season also affords me two new varieties of the vine with striped fruit and variegated autumnal leaves, produced by the white chasselas and the farina of the Aleppo vine: one of these has ripened extremely early, and is, I think, a good grape. When perfectly ripe, I propose sending a bunch of it for the inspection of the Horticultural Society.

"In all attempts to obtain new varieties of fruit, the propagator is at a loss to know what kinds are best calculated to answer his purpose; and therefore I have mentioned those varieties of the grape from which I have propagated with the best prospect of success. My experiments are, however, still in their infancy; and I do not possess the means of making them on so large a scale or in so perfect a manner as I wish; nevertheless, the facts of which I am in possession leave no grounds of doubt in my mind, that varieties of the grape, capable of ripening perfectly in our climate when trained to a south wall, and of other fruits better calculated for our climate than those we now cultivate, may readily be obtained; but whether the mode of culture I have adopted and recommended be most eligible must be decided by future and more extensive practice.

"I have made experiments similar to the preceding on the peach; but I can say no more of the result of them, than that the plants possess the most perfect degree of health and luxuriance of growth, and that their leaves afford satisfactory evidence of the good quality of the future fruit. I am ignorant of the age at which plants of this species become capable of producing blossoms; but the rapid changes in the character of the leaves and growth of my plants, which are now in their third year, induce me to believe that they will be capable of producing fruit at three or four years old.

"I shall finish my paper with stating a few conclusions, which I have been able to draw in the course of many years' close attention to the subject on which I write.

"New varieties of every species of fruit will generally be better obtained by introducing the farina of one variety of fruit into the blossom of another, than by propagating from any single kind. When an experiment of this kind is made between varieties of different size and character, the farina of the smaller kind should be introduced into the blossoms of the larger; for, under these circumstances, I have generally (but with some exceptions) observed in the new fruit a prevalence of the character of the female parent; probably owing to the following causes—The seed-coats are generated wholly by the female

parent, and these regulate the bulk of the lobes and plantule; and I have observed, in raising new varieties of the peach, that when one stone contained two seeds, the plants these afforded were inferior to others. The largest seeds, obtained from the finest fruit, and from that which ripens most perfectly and most early, should always be selected. It is scarcely necessary to inform the experienced gardener, that *it will be necessary to extract the stamina of the blossoms from which he proposes to propagate, some days before the farina begins to shed, when he proposes to generate new varieties in the manner I have recommended.*

"When young trees have sprung from the seed, a certain period must elapse before they become capable of bearing fruit, and this period, I believe, cannot be shortened by any means. Pruning and transplanting are both injurious; and no change in the character or merits of the future fruit can be effected during this period either by manure or culture. The young plants should be suffered to extend their branches in every direction, in which they do not injuriously interfere with each other; and the soil should just be sufficiently rich to promote a moderate degree of growth, without stimulating the plant to preternatural exertion, which always induces disease.* The periods which different kinds of fruit-trees require to attain the age of puberty are very varied. The pear requires from twelve to eighteen years; the apple, from five to twelve, or thirteen; the plum and cherry, four or five years; the vine, three or four; and the raspberry, two years. The strawberry, if its seeds be sown early, affords an abundant crop in the succeeding year. My garden at present contains several new and excellent varieties of this fruit,† some of which I shall be happy to send to the Horticultural Society."

The coincidence in thought and in illustration between Cooper and Knight is remarkable; and yet it is evident that both were original. Knight, in illustrating the extremes of heat and cold which plants can endure without injury, has these remarks: "In Jamaica and other mountainous islands in the West Indies, the air upon the mountains becomes soon after sunset chilled and condensed, and, in consequence of its superior gravity, descends and displaces the warm air of the valleys; yet sugar canes are so far from being injured by this sudden decrease of temperature, that the sugars of Jamaica take a higher price in the market than those of the less elevated islands, of which the temperature of the day and night is subject to much less variation." "The mango, (*mangifera Indica*,) though a native of a very hot and bright climate, and capable of bearing, with apparent benefit, the hot drying winds of Bengal, vegetates freely and retains its health in

* "The soil of an old garden is peculiarly destructive."

† "The hantboy strawberry does not appear to propagate readily with the other varieties, and may possibly belong to an originally distinct species. I have, however, obtained several offspring from its farina; but they have all produced a feeble and abortive blossom. If nature, in any instance, permits the existence of vegetable mules (but this I am not inclined to believe), these plants seem to be beings of that kind."

comparatively low temperature, and under a cloudy atmosphere. The plants which I possess sprang from seeds, in October, 1818, and are now, (December, 1819,) shooting strongly, although in a temperature rarely so high as 60°. Mr. Turner, in his Journey to Thibet, states that he found the mango growing in latitude 27° 50', in Boutan, in the same orchard with the apple tree; the apples ripening in July, and the mangoes in September."

What I am anxious to impress upon Australians in this early stage of their husbandry, is the cultivation of habits of patience and perseverance, along with the cultivation of the products which they wish to introduce, for the exercise of which they will have abundant scope. Dr. Walker has recorded as a curious fact, that though the yew tree is a native of Sweden, all the yew plants sent from Paris to plant Le Notre's designs, died at Stockholm the first winter. My inference from that fact is, that French acclimation had in that instance so revolutionized the French variety as to have unfitted it for direct resumption of habitat in its own connatural country. De Leuze has observed that though it is difficult to form vegetable collections in northern countries, industry conquers obstacles, and the more precautions are necessary to secure plants from the rigor of a climate, the more will culture be perfected; and Loudon has well remarked, that nothing could be more extraordinary in the way of gardening than the well known fact, that though a century ago there was scarcely such a thing in any part of Russia as a garden, there had been for the last fifty years more pine-apples grown in the neighborhood of Petersburgh than in all other countries of the Continent put together. But my crowning illustration on this subject shall be the record of old Parkinson, that our English ancestors, in the days of Queen Elizabeth, had the patience to reconcile the laurel or bay cherry, which is now as hardy as if had been "a native Briton," to an English habitat, by defending their bantling "from the bitterness of the winter, by casting a blanket over the top thereof!"

Cotton culture being the coronal topping of the aspiring special branch of Australian husbandry, and recent events in America having attached unusual interest to a product likely to be, as an Australian staple, second only in commercial importance to wool, and the culture of that product being unknown in English husbandry, I am induced to go somewhat more into detail as to it than I thought myself called upon to do in regard to any other vegetable product.

Cotton, it is well known, is the wool or down which surrounds the seeds of a plant botanically named *gossypium*, of which the consumption is enormous; and though I have arrived at the conclusion that cotton culture in Victoria will be best experimentally commenced in the sixteen millions of acres situate between the River Murray and the 37th parallel of south latitude, and shall, as a consequence of that conclusion, propound that cotton, as well as cane-sugar, will be most profitably cultivated in plantations in northern Victoria, set apart especially for the purpose, and cropped in alternation with each other: I am nevertheless of opinion that much may be done, as to both products, in favorable locations in other parts

of the colony, as parcel of domain culture; inasmuch as room may be made for such of the perennial varieties of cotton as reach tree dignity in the special culture allotment numbered 1, and for the less permanent varieties, intended to be cultivated as sub-perennials, in the special culture allotment unnumbered 22, whilst such of the varieties as will submit to strictly annual cropping may pass through the Victorian course, along with sugar beet, in the summer cropping of the field, classed as the sixth in my arable rotation; or along with hemp, flax, and other textiles, in the summer cropping of the field classed as the eighth in that rotation; or along with the cropping of both fields, if demand for cotton shall so require.

The manufacture of cotton into cloth is unquestionably of remote antiquity, though it appears that that of linen preceded it, for it is recorded of Solomon (2 Chronicles i. 16), that his merchants received linen yarn, at a price, from Egypt. There has been much controversy as to whether the wrapping cloths of the Egyptian mummies were made of linen or cotton; but the microscope, in the hands of Dr. Thomson, has demonstrated that the material so used was linen, and not cotton. Herodotus, however, who wrote about 445 years before the Christian era, expressly states that the Indians possessed a plant which, instead of fruit, produced wool, of a finer and better quality than that of sheep, of which they made their clothes; so that cotton culture, and the manufacture to which that culture has given rise, have a clear antiquity of more than two thousand years.

The cotton plant was early grown in Egypt, and also in the island of Tylos, in the Persian Gulf. "In Upper Egypt," writes Pliny, "towards Arabia, there grows a shrub which some call gossypium, and others xylon, and from which the stuffs are made which we called xylina. (Xylon, it is to be observed, was the Greek name of the cotton plant.) It is small, and bears a fruit resembling a nut, within which is a downy wool, which is spun into thread. There is nothing to be preferred to these stuffs for whiteness or softness; beautiful garments are made from them for the priests of Egypt." Pliny, in his description of the island of Tylos, (following the Greek naturalist Theophrastus,) enumerates among its remarkable productions "wool bearing trees," with leaves exactly like those of the vine, but smaller; these trees, he says, bear a fruit, which bursting when ripe, display a ball of downy wool, from which are made costly garments, of a fabric resembling linen.

It is clear also that the manufacture of cotton was in use in Mexico before its conquest by the Spaniards; for history has recorded that Cortes was presented with garments of cotton, and with cotton cloth to cover his huts; and cotton cloth has been discovered among the relics found in their earliest tombs, so that some species of cotton are clearly indigenous in America.

Among the peculiar incidents of cotton culture which I have noted in my researches on the subject, are the revival of that culture in Egypt, by Ali Pasha, in the year 1821, after a discontinuance of fifteen hundred years, and the extraordinary fact, (if fact it be,) that the celebrated Sea Island variety should, after migrating from the East to the West Indies, *via* Europe, and becoming famous in the West, re-migrate from the West Indies to its original eastern clime, *via* Bourbon, and be received under its

novel name of Bourbon cotton, as an invaluable acquisition to the flora of the very region which gave it birth !

We know nothing earlier of the culture of cotton in Europe, than that it was introduced into Spain from Morocco, by the Moors, in the tenth century, and that it was established in Italy in the fourteenth. The cotton manufactories of England, which are comparatively modern, were long supplied with the raw material from the Levant, and subsequently from the West Indies. It is stated, in Wilson's account of the "Province of Carolina, in America," published in 1682, "that cotton of the Cyprus and Malta sort grew well, and a good plenty of the seed was sent thither;" which I quote to show that if the *gossypium barbadense* is in reality identical with the *gossypium herbaceum*, (as Baines intimates, and states that the Sea Island variety was probably of Persian origin,) it is much more likely that the West Indies should have received it, in the progress of colonization, from Persia, *viâ* Cyprus and Malta, than that Persia should have been its recipient from the West Indies.

The general introduction into use of Arkwright's spinning machinery, in 1769; the establishment of the factory system, in 1785; and improvements soon afterwards effected in other machinery and in the arts of bleaching and calico printing; gave, in combination, the astonishing impetus to the cotton manufactures of England, which has resulted in the production of the most wonderful industrial development of all ages and of all countries; and though, in justice to India, I have recorded the true birth place of the cotton manufacture, a patriotic feeling impels the addition, that its majestic growth was wholly due to English nurture.

In the year 1781, the aggregate importation of cotton into Britain from all parts of the world was only 3,198,778 lbs.; but, in 1789, when the American States were intending to participate in cotton culture, it had augmented to 32,576,000 lbs., which were thus supplied:—

	lbs.
British West Indies	10,128,000
French, Spanish, Portuguese, and Dutch colonies ...	15,600,000
Surat and the East Indies	2,000,000
Isle of France and Bourbon	148,000
Smyrna and Turkey	4,700,000
	32,576,000

In the year 1833, the importation of cotton into Britain had augmented to 303,656,837 lbs, of which 83,139,050 lbs. were from the East Indies, being somewhat over the entire supply of the year 1789; which shows that, in the 44 years which had elapsed between the two dates, cotton culture had greatly progressed in India, though not in the surprising ratio at which it had progressed in America; for the American States exported, in 1791, only 19,200 lbs., which was their then entire produce,—the States having at that date no cotton manufacturing establishments of their own: but, in the year 1833, the quantity exported from the States had augmented to 216,000,000 lbs., after retaining 39,000,000 lbs. for the employment of their own looms.

The production of cotton has augmented amazingly since the year 1833, in various parts of the world; but the American States retain the lead which they had then taken, and have, of late years, supplied Britain with six-sevenths of all the cotton manufactured there.

The quantities of raw cotton consumed in the chief manufacturing countries of the world in 1856 (says Simmonds in his *Dictionary of Trade Products*, published at London in 1858) were, in millions of pounds, as follow:—Britain, 920; Russia, Germany, Holland, and Belgium (together) 256; France, 211; Spain, 48; countries bordering on the Adriatic, 39; Mediterranean and other countries, 56; and the United States of America, 265;—making a total of 1795 millions of pounds!

The following transmigrations of a small parcel of cotton wool evince the importance of the cotton plant, and the ramifications of the trade to which it has given rise. The parcel, after a voyage from India to London, was sent to Manchester to be manufactured into yarn; after which it made its first appearance in Paisley to be woven; thence it was sent into Ayrshire to be tamboured; after which it made its second appearance in Paisley to be veined; after that it was sent to Dumbarton to be hand sewed; after which it made its third appearance in Paisley, whence it was sent to Renfrew to be bleached; after which it made a fourth appearance in Paisley, whence it was sent to Glasgow to be finished; after which it was despatched by coach to London. The time which intervened between the package of the wool in India and its arrival as cloth in the merchant's warehouse in London, after its many northern excursions, was three years, in the course of which it had travelled five thousand miles by sea, and one thousand by land, and had contributed to the support of one hundred and fifty people, who, however, by their combined efforts, had increased its value full two thousand per cent.!

It luckily happens for Australians that the English East India Company were induced, in 1788, to attempt the extension and improvement of cotton culture in their Indian provinces, where, as I have stated, cotton culture originated, and where the process of manufacture had arrived at such a superlative degree of perfection as that the epithet "a web of woven wind" applied to Dacca muslin, was scarcely hyperbolical, inasmuch as we have the testimony of an English missionary that Dacca muslins were so exquisitely fine that, when laid on the grass and the dew had fallen upon them, they were no longer visible: and also that, simultaneously with the proceedings of the company in India, the introduction of cotton culture was effected in Georgia and Carolina, where, it is to be borne in mind, that culture had not pre-existed. From these simultaneous movements, Australian agriculturists can reap the benefit, as well of the company's experience as of that of the American States also, and can thereby see the importance of care in preparing cotton for the English market; for it was unquestionably owing to the prejudices of the Hindoos against innovation in their antiquated mode of culture and market preparation, and the greater attention of the American planters to the preparative requirements of their English customers (combined with the fortunate incidents of the almost accidental acquirement by the Americans of the Sea Island variety of cotton, and of

the invention in 1793, by Mr. Eli Whitney, of Massachusetts, of an implement called a saw-gin, with which a man could effectually cleanse from seeds and dirt 3 cwt. of cotton in a day, without the injury to its staple which beating in the old way occasioned); whilst Hindoo culture and management remained stationary, that the American plant unexpectedly grew into a giant whilst the East Indian plant, originally of greater promise, got stuntedly dwarfed.

The great cotton district of America comprises the States of Virginia, Carolina, Georgia, Alabama, Mississippi, Louisiana, Tennessee, Arkansas, and Florida, and (overlooking the elongated part of Florida, because it is insufficient in breadth to entitle the mass of the district to claim much in respect of its own southern position), may be considered as lying between the parallels of 30° and 36° north latitude. I have, in an earlier part of this essay, adverted to the statement of Humboldt, that mere latitude is not to be relied upon as an infallible criterion of climate adaptation for particular products, inasmuch as many influences have combined to give to Australian climates great advantage over those of America, which lie in approximate position; and it being admitted in physical geography that the isothermal line which would pass through Australia about latitude 35° would cross America about 30°, it will I apprehend, as a consequence, be found on investigation that, for cotton growing, the soil and climate of the land of Victoria which lies between the 34th and the 37th parallels are as eligible as those which lie between the 30th and the 36th of the North American continent. If climate heat beyond a given degree had been of greater avail than it is in cotton culture, it is obvious that the East Indian plant would have been the giant and the American the dwarf; for all accounts agree that cotton is moderate in its requirements as to moisture, in which alone the American States had the advantage over much warmer East Indian provinces: and though it is true that the best varieties of cotton at present in cultivation which happen to have had a tropical origin are very sensitive to the influence of frost, it does not follow, as an inevitable consequence, that new varieties originating in cooler climates from those tropical originals will, of necessity, retain the extreme temperature susceptibility of their hot climate precursors. The fact is, that the aversion of the Hindoo cultivator to innovation of any kind, and adhesion to an imperfect system of market preparation spoil the commodity which India produced in greater perfection than America, and thereby threw the immense advantage of a lucrative branch of husbandry into the hands of the Americans exclusively, because they compelled their slaves to attend to the requirements of their English customers, and invented (as we have seen) a saw-gin to perfect a preparation which the East India Company failed to obtain from their coolies with the obsolete machinery which those coolies persisted in using. The consequence was that the better material became, under competition, the half-price article, and the result, in the sequel, was the monopoly by the United States of six-sevenths of the entire supply of Britain, leaving only a single seventh for the produce of India, Brazil, the West Indies, Egypt, and the rest of the world conjointly, a circumstance which, in my mind, indicates great peril in any resort to coolie labor and coolie

management in the introduction of cotton culture into Australia, and points to the conclusion that coolie management and labor are only to be resorted to when better is not to be had. I should much prefer the introduction of emancipated negroes with their families from the cotton-growing States of America, and, as I apprehend one great consequence of the American crisis will be a disruption of the slavery tie in the southern States, free negro labor will become abundant, and, consequently, cheap enough for Australian importation; and it is to be remembered that that labor is already skilled in the cultivation of the article about which we are now so anxious.

As the cotton plant, though intertropical as to climate, is certainly indigenous in Asia, Africa, and America, and that, too, beyond strictly tropical bounds, and as Dr. Mueller, in his *Fragmenta Phytographia Australiae*, published at Melbourne in 1859, thus describes a plant, "*Malvaceæ Gossypium Australe*," I assume it to be indigenous in Australia also; and as the cotton plant (on the authority of Royle) has been found flourishing in such far distant islands as the Galapagos, the Sandwich, the Seychelles, Java, Borneo, and other islands of the Indian Ocean, and also in the islands of the Chinese coast extending up to Japan, and as cotton has yielded to successful culture in Sicily, Naples, Malta, Spain, the Levant, Egypt, Morocco, China, Persia, and many other places, as well as in India and America, and has thriven in Turkey as high as the 43th parallel of latitude; and as, on the authority of Stuart, an American traveller from whom I shall quote, it has to some extent supplanted tobacco culture in the comparatively northern State of Virginia; and as the Sea Island variety, though considered by some to be a native of the arid climate of Persia, has attained its greatest present development in the comparatively ungenial climates of Georgia and Carolina, cotton cannot be so nice in its climate requirements as some authorities surmise: and I hold it to be the duty of the Executive of Victoria to demonstrate to England forthwith, by a series of trustworthy observations and experiments in well-selected districts, that several profitable varieties of cotton do not require more climate heat for their perfect development than favoured localities in northern Victoria and in Gipps Land, at all events, possess. Experiment in southern Victoria may await until the result of the first process shall have vouched the cotton-growing capabilities of the colony in the affirmative. As the 43th parallel of latitude is the highest point which I have seen instanced in cotton growth, I shall quote my authority, which is that of Dr. Jennings in his *Family Cyclopædia*, published in 1822: "Cotton although a native of the torrid zone, is yet produced in Turkey as far as 45 degrees north latitude." There is evidently a predisposition in England, grounded probably on erroneous impression as to climate requirement, to acclaim Queensland as pre-eminently the cotton colony of Australia; so that, if Victorians are sensible and do not incidentally exhibit in fair rivalry the climate advantages of their splendid district north of the mountain ranges, they are not to be surprised if Madame Queensland laughingly appropriates to herself the Austral cottonian wreath, regardless of the rights of older sisters to coparceny in its wear. I have to add, that Royle has cited Astrakhan, in latitude 46°, in the Eastern hemisphere, as

his extreme latitude as to eastern culture, and has mentioned latitude 37° as his American extreme, being in both cases a degree beyond my instances; and I notice that Phillips, in my extract from him, intimates that a species of cotton plant has been found in America in latitude 40° , so that Mistress Tasmania need not despair of sharing with her juvenile sister an occasional right to the wear of the gossypium wreath.

The River Murray leaves the colony of Victoria (of which it is for 560 miles the northern boundary) near the 34th parallel of latitude, and between that river and the 37th parallel is situate the sixteen millions of acres of splendid cotton-climated land to which I have before adverted. A glance at the map of the colony of Victoria prefixed to this essay will show the position of the mountain ranges which so eligibly divide the colony precisely where convenience would desire. I have always considered the position of those ranges as the finest physical feature of the colony (apart from any appreciation resulting from their auriferous and other mineral treasures), and that the dual climate blessing which emanates from that position confers just title to the epithet *Australia Felix*, which was first bestowed on the colony as its name. It is obvious that no English garden was ever better protected by judiciously placed walls than the hulk of this highly favoured district is by the position of the ranges, and as the whole of the north Victorian watershed is northerly towards the Murray, it is apparent that, if it were possible to move the colony round, as on a pivot, to obtain a sunny aspect, that which a benignant Providence has kindly bestowed could not be improved upon. The district in question has, moreover, the rare Australian advantage of being well watered by the numerous rivers and rivulets shown on the map, which originate in the ranges and flow into the Murray.

As I do not see how Queensland can have cheaper labor than Victoria might have, and as there can be no doubt as to the soil capability of Victoria in its southern as well as in its northern division, the question as to the capability of Victoria to compete with Queensland in cotton culture appears to me to be simply, what are the climate requirements of the various profitable varieties of cotton, and to what extent does Victoria possess land able to meet those requirements? I have seen a statement that cotton may be grown to advantage where the mean summer heat averages 74° , and the mean winter heat is not less than 46° , if the climate affords at least eight calendar months between the frosts of spring and those of autumn. With these requirements I apprehend more than half the colony of Victoria could comply, seeing that the report on its climate, included in that on its resources, to which I have elsewhere adverted, states that in Melbourne the mean temperature of the air was for the years 1858 and 1859, 57.8° , and that the mean temperature of the surface soil of Melbourne for a year had amounted to 60.58° ; it being to be observed that the mean of the summer and winter heat (74° and 46°) stated to be those required for the advantageous growth of cotton, is 60° . I have also seen a Melbourne statement, that, up to a given period in 1860, 365 consecutive days had yielded a mean temperature in Melbourne of 72.5° for the summer portion, and 45.3° for the winter; which, if correct, is not disparaging, but on the contrary trends to the assurance that in localities further north than Melbourne, and especially in those

which have the advantage of protection by the mountain ranges, combined with a northern aspect, and the Murray watershed, many of the more delicate varieties will succeed. We have, moreover, the statement of Humboldt, that the *Gossypium herbaceum* is successfully cultivated in the temperate zone, where, with a mean summer heat of 73° to 75° , that of winter is not less than 46° or 48° ; so that the success of cotton culture to some extent in Victoria may be safely predicted. It is matter of notoriety that in the great North American cotton district, the temperature of many winters gives an average much below 46° , and I have seen statements which reduce the average duration of the cotton growing season, over a moiety of the great North American district, to seven months certain, and, in some other places, to eight; whereas the average of the bulk of the colony of Victoria can, I apprehend, be sustained at nine, and, in the district below the 37th parallel of latitude, and in favored parts of Gipps Land, at ten months.

It may tend to success, if, in the introduction of cotton into Victoria, preference is given to seed grown in the northern states of Virginia, Carolina, and Georgia, because the plants produced from such seed are likely to be hardier and less sensitive as to temperature than plants grown from seed of warmer regions; and I think it probable that sixty years of Virginian and Georgian culture has constitutionally so modified the Sea Island variety there grown as to have adapted even it for some Victorian habitats, notwithstanding the supposition that failure might be feared as the result of an attempt to introduce that variety into Southern Victoria direct from the much warmer regions of either Persia or the West Indies, to one of which its origin must be assigned. It is only of late years that the climature department of agriculture has had philosophical consideration.

A cotton plantation at the gathering season, when the globes of snowy wool are seen among the glossy dark green leaves, is said by travellers to be singularly beautiful; and in the hotter countries, where the yellow blossoms and the ripened fruit are seen at the same time, the beauty of the plantation is considered to be greatly enhanced.

American cultivators of cotton have hitherto confined their attention to three varieties, which, though in fact perennials, are, owing to the abundance of slave labor, somewhat prodigally cultivated, as if they were mere annuals. These varieties are the Nankin, the wool of which is yellow; Upland Georgian, the wool of which is white, but which variety is also called "green seed," from the color of its seed; and the Sea Island, the wool of which is a yellowish white, and the seed black, which has caused the variety to be occasionally called the black seed kind.

Apart from the importance of cotton as a textile product, it is to be borne in mind that cotton seed contains a large quantity of almost colorless oil along with a brown resinous substance which colors the oil when expressed. The seed has been employed in cotton growing countries to make pectoral emulsions, because of the oil which it contains, combined with mucilaginous and saccharine principles; all of which, being nutritious and non-repugnant in taste, are universally employed in India and China in the feeding of cattle. The oil is also used as a lamp oil.

British attention having been called to the oil of cotton seed, an apparatus

was constructed to free the seeds from the short down or fuzz in which they were enveloped, before subjecting them to pressure in the oil press. The oil is described as being of a brownish color, with a slight tinge of green, and has been compared to oil expressed from partially scorched linseed, and it has been suggested that it might be useful in wool dressing. Dr. Anderson, the chemist to the Highland Agricultural Society of Scotland, is reported by Dr. Royle to have had sent to him the refuse cake obtained after the expression of the oil, which he thus described: "The cake had a brown color, and contained large fragments of the husk of the seed. It was very brittle, and broke much more readily than linseed cake; moistened with water, it appeared to be much less mucilaginous than that substance. Its taste was not unpleasant." In its analysis, Anderson pursued the method usually employed for linseed cake, determining simply those constituents upon which its feeding value was believed to depend, viz:—

Water ...	...	...	...	...	11.19
Oil ...	...	...	...	...	9.08
Sugar ...	...	...	...	...	10.70
Albuminous compounds (nitrogen, 3.95) ...					24.69
Ash * ...	...	...	...	...	5.64

"By comparing these results with those of linseed cake, Anderson (observed Royle) found that this substance possessed very considerable feeding properties. The quantity of oil contained in linseed cake varies from 9 to 11, and is sometimes even as high as 12 per cent.; the quantity of nitrogen is about 4.5 per cent. These being the most important constituents of oil cake, and those by which its value is to be mainly determined, shewed that though the analysis fixed the value of cotton cake below that of linseed cake, it was nevertheless sufficiently high to make it a substance of very great importance to agriculturists."

I consider this valuable seed property of the plant as greatly enhancing the importance of cotton culture in Australia, because of the additional supply of cattle food and oil which will result from that culture, when it shall have been introduced into Australian husbandry.

Akin to cotton as a product is the down of a tree of magnificent growth called *Bombax Ceiba*, which is said to attain the height of 100 feet, and which, having a fine spreading top, is familiarly called the umbrella tree. Though not of the *Gossypium* family, it appears to me to call for notice in Australian husbandry, because it produces a silky cotton like down, very soft and white, which has been found useful for stuffing pillows and beds, and supplying the purposes of feathers and down, though found to be too short and brittle for spinning purposes. It grows on the coast of Guinea, where it is held in veneration by the negroes, and it has been found also in the West Indies, and in South America and elsewhere. Vegetable introductions may be made at such a comparatively light cost, that I shall

* The ash contained—1.32 silica; 2.19 phosphates; 0.15 excess of phosphoric acid.

consider Australian husbandmen supine if such a shade tree as this for Australian pastures is not permitted to compete among the sylvans of Australian husbandry.

The seed of the herbaceous and barbadense varieties is, when cultivated as an annual in northern latitudes, planted in March, April, and May, and the crop is gathered in August, September, and October. In America, it is common to plant in rows four feet asunder, and sixteen inches between plant and plant in the row, on the Jethro Tull or drill system; but in India the cultivation has hitherto been very slovenly conducted on the broad cast principle, and without the least regard to crop rotation; and as the plantation is neglected at every stage of its growth, and there is also negligence even in the gathering of the crop, and in the process of detaching the seed from the down, the consequence is that Indian cotton is never worth half the price at which American cotton of the same kind sells.

It being important in cotton-growing to obtain as great a length of staple as is compatible with strength in texture in some cases, and silkiness in others, recourse must be had, in Australian husbandry, to the Sea Island variety (which is pre-eminent among cottons for its length of staple), in the endeavor to produce hybrids between it and the more promising varieties of the *Gossypium Australe* of Mueller, and the hardier varieties of the *Gossypium acuminatum*, herbaceum, and arboreum, and of such other species and varieties as shall be found, on trial, to thrive best in Australia: and I would, in the way of encouragement, remind Victorians how effectively Nature co-operated with Science in hybridising, in the instance of alsyke, in the clover family, its two choicest products of white and red.

The following documents and extracts throw light upon early cotton culture, when it was, as it were, in the sapling stage of its growth, and are therefore interesting to those who have it in charge to expand the *Gossypium Australe* into the most gigantic species of its genus, speaking metaphorically, and in a commercial point of view.

"A very interesting set of experiments (says Dr. Royle) in crossing one cotton with another, was made by Dr. Thompson, at Sydney, and in the neighborhood of Moreton Bay; and some cotton has been grown at Bolwarra, near West Maitland. The plants were, when young, attacked by a grub, but many recovered from this, grew steadily, and became from 3½ feet to 5 feet high, branching, bushy plants, bearing on an average about thirty pods each; and it was remarked that the hot winds of the season when the experiment was made did not seem to injure the plants. But cotton plants (continues Royle) are able to bear a good deal of heat when they have not been previously exposed to much moisture; and as the experiment was made in rich alluvial land, they were, no doubt, able to draw sufficient nutriment from the soil. There can be no doubt that cotton plants may exist through a long range both of temperature and of atmospherical moisture and dryness."

As the following quotations from Dr. Royle's "Illustrations of the Botany of the Himalaya Mountains," published in 1839, uphold to some extent my

supposition, that the Colony of Victoria may fairly indulge in the idea of competing with Queensland in the production of good commercial cotton, I shall here introduce them: "In a cultivated state, cotton is now distributed over a very wide expanse of the globe, on both sides of the Equator; on the north extending as far as the southern shores of Europe, and on the south to the Cape of Good Hope; in the islands of the Pacific Ocean, it is found, both in the Friendly and the Society Islands; nearly under the Line, it is cultivated in the islands of Celebes, Java, Timor, and the Seychelles, as well as in Kutung, where the best is said to be grown; extending northwards up to the Malayan peninsula, along the coast of Tenasserim into the Burmese territory, and from this westward into Siam and China, where there is a peculiar species. Cotton is common in every part of India; a wild species was found in Ceylon, and another in Silhet, by Dr. Roxburgh. From India the cotton plant seems to have travelled by the way of the Persian Gulf, into Arabia as well as into Persia, and from thence to Syria and Asia Minor. From Arabia, it was probably introduced into Egypt *via* the ancient commerce of the Red Sea with India, whence it seems to have spread into the interior of Africa, and to both its western and its northern coasts. The islands and shores of the Mediterranean long supplied Europe with all the cotton it required. During the reign of Napoleon, he caused it to be introduced into Corsica, Italy, and the southern parts of France; and Mr. Kirkpatrick cultivated it near Malaga, in Spain." "*Cotton is cultivated as high as 37° of north latitude in America; beyond 40° in Europe; and even as far north as 46° near Astrakhan.*" "With regard to latitude, the cotton of Java, under the Line, is almost the worst in the market, while that from Guiana and Brazil, within a few degrees of the Line, is the second in quality; and that from Jamaica, in 20° north latitude, which is more costly in production, is 30 per cent. worse than that from Demerara, 14° more to the southward; while the cotton of Georgia and the Carolinas, nearly at the northern limit of its extension, is the best that is produced; and the cotton of Egypt, of which the cultivation, with returning civilization, has returned to the country by which it was first made known in Europe, is of excellent quality." "It would appear, therefore, that not only is temperature necessary to be considered, but also the due balance between the supply of moisture to the roots, and its escape by the perspiratory surfaces of the leaves, as well as all the varied processes of a judicious culture, in addition to the choice of the species or variety to be cultivated in any particular locality. In the choice of seed, it does not follow that that which is best suited to one climate is the kind most eligible for introduction into another, where the requisites of soil and climate may be neither identical nor analogous. Dr. Rohr and Mr. Bennett mention that even in the same field, some plants were ten times more productive than others, and that a variety which was sterile in one situation became fertile when removed to another, which did not appear more favorable; while a kind that in one bore but little cotton, became most productive in a neighboring farm. Much, therefore, may be done in improving the kinds which already exist, by ascertaining with precision the parts of the country where the best cotton is already produced, the peculiarities of soil, climate, and culture,

selecting the most prolific plants, and extending their cultivation, to the exclusion of less fertile and inferior kinds; exchanging the produce of one place with that of another, and in selecting and preserving the best kind of seed. Doing, in fact, what is everywhere done by all who are interested in the improved cultivation of grain, vegetables, fruits, or flowers; and though some varieties are difficult to propagate by seed, yet others may be continued sufficiently long to attain the permanency of species, instead of the liability to change of varieties."

"The commercial value of cotton" (says Dr. Royle in his Treatise on the culture and commerce of cotton, published in 1851) "depends as well on the length, strength, and fineness, as on the softness and equality of the fibre. But these essential qualities are modified by color and cleanliness; that is, freedom from knots and impurities, so that there may be less waste in spinning. Formerly color had great influence, but now the great distinction is into long stapled and short stapled. Sea Island, or long stapled cotton, is the most highly esteemed of the cottons; and is remarkable, as well for the length and fineness of its fibre, as for its silky softness. Amongst white cottons it is distinguished by a slight yellowish tinge. It sells from 1s. 6d. to 2s., and has sold as high as 7s. a pound. The quantity is limited, from the peculiarity of the physical circumstances required for its production. The fibres are equable, about an inch and a half in length. Uplands, or short stapled cotton, under which names are now usually included the produce of the interior of Georgia and Carolina, as well as of Alabama, Mississippi, Louisiana, and Tennessee. It used to be, and is sometimes still, called bowed, from the cotton of Georgia having formerly been cleaned with the Indian cotton bow. Though shorter in the staple, and unequal, this, which is white in color, is much esteemed, and forms the bulk of the cotton of commerce. The staple is from an inch, to an inch and a quarter in length. The best Egyptian cotton ranks next to the Sea Island in quality and length of staple, though it is not usually so well cleaned. It was only about the year 1821 that the Pasha began cotton cultivation, by importing seed from America, the Mediterranean, and Brazil. These different kinds may, therefore, be met with in cultivation there; though the Sea Island yields the best kind of Egyptian cotton, which is there called Maho. It has a staple of one and a quarter to one and two-thirds inches in length. Some excellent cotton has been sent from Port Natal, and some from the west coast of Africa; that from the Island of Bourbon used formerly to be much esteemed. The West Indies supplied England with the bulk of its cotton in the eighteenth century, but the cultivation was neglected when sugar became more profitable. West Indian cotton is long stapled, silky, and might be produced of a quality equal to Sea Island. Bourbon cotton is the same species as that which is cultivated in the West Indies. South American cotton was, in 1780, considered by Bryan Edwards as the finest grained and most perfectly cleaned of that which was then brought to the English market; especially that of the Dutch plantations of Berbice, Demerara, Surinam, and Cayenne. The Pernambuco was afterwards sent of so fine and superior a quality, as to be highly esteemed; and its price ranked next

to the Sea Island. The staple is long and fine, generally well cleaned, and glossy; some with a yellowish tinge spins into a stout yarn, which is much esteemed by hosiers. East Indian cotton varics much, and is all short stapled; but it is esteemed for its color, though it is generally sent in a dirty state to market. Much cotton is cultivated in the countries surrounding the Mediterranean Sea. It is generally the produce of Indian species of the plant, though American seeds have been introduced into other places than Egypt. The cottons cultivated in Asia Minor and Greece, are generally known as those of the Levant and Smyrna cottons. The Italian cottons are produced in Sicily, in Calabria, near Naples, and in Malta; those of Calabria and of Castellamare are the best, and are probably the produce of an American species. A Nankin cotton is cultivated in Malta, and used there. Most of these cottons are employed for native manufactures, in the countries where they are grown, or are exported for the use of the manufactures of the continent. They seldom reach England, except when the price of cotton is very high."

"The foregoing account of the several varieties of cotton may be appropriately concluded with the following tabular statement of the kinds and prices of cotton, as named in commerce, from the places of export."

Species of Cotton.	Commercial kinds of Cotton.	Prices per lb. in 1849.	
		d.	d.
Gossypium Barbadense	Sea Island	9	to 24
	Egyptian	6	— 9½
	New Orleans	5½	— 8
	Mobile and Alabama	5½	— 7½
	Uplands	5½	— 6½
	Demerara and Berbice	5½	— 8
Gossypium Peruvianum or Acuminatum	West Indian	5½	— 6½
	Peruvian	6	— 6½
	Pernambuco	6	— 6½
	Aracali and Ceara ...	6½	— 7
	Maranhão and Para ...	6	— 6½
	Bahia and Maceio ...	6	— 6½
Gossypium Indicum or Herbaceum	La Guazana	5½	— 6
	Carthage	4½	— 4½
	Smyrna	5	— 5½
	Prime Surats	5	— 5½
	Common Surats	3½	— 5
	Madras	4	— 5
	Bengal	2½	— 3½

"The cotton plant," (says Baines in his History of the Cotton Manufacture in Great Britain, published in 1835,) "in all its varieties requires a dry and sandy soil. This is the universal testimony of travellers and naturalists. It flourishes on the rocky hills of Hindostan, Africa, and the West Indies, and will grow where the soil is too poor to produce any other valuable crop. A mixture of siliceous and argillaceous earth is the most desirable, with

a preponderance of the former. A marshy soil is unfit for the plant ; and so little congeniality has it for moisture, that a wet season is destructive to it. Of the several diseases to which cotton is subject, and which make the crop a precarious one, the most fatal is the blight produced by wetness at the roots. The plant flourishes most, and produces cotton of the best quality, on the sea coast. It was mentioned, as long since as the twelfth century, by an Arabo-Spanish writer, that in Spain the sea coast was found best suited to the cotton plant. The same fact is familiarly known to the cotton planters of India, China, Demerara, and Western Africa. And above all, the proximity to the sea is found to be indispensable to the growth of the best cotton, by the experience of the planters of South Carolina and Georgia, who raise the finest cotton known, namely, the Sea Island, on the sandy coasts and low islands of the sea, and who find the same cotton degenerate, in length of staple and in quality, when grown inland. To this rule there are, however, two exceptions. The Pernambuco cotton, which is second only to the Sea Island in value, though still much inferior, is said by Koster to be injured by proximity to the sea, and improved as the planters recede from it. In Egypt also, it is reported by St. John in his travels, that 'the cotton of the upper provinces several hundred miles from the sea, is superior to that of the Delta.'

"The celebrated Sea Island cotton," (says Baines in another part of his history,) "is much longer in the fibre than any other description. It is also strong, and even of a silky texture, and has a yellowish tinge. Its seed is black ; whereas most of the other American cotton is produced from green seed. It is of the annual herbaceous kind, and though introduced from the Bahama Islands into Georgia, it is supposed that Persia is the native country of the Sea Island species. The soil, and situation of the low sandy islands, which lie along the coast from Charlestown to Savannah, were found extremely congenial to the plant ; and from them the cotton which it produces derives its name. The quantity raised is however limited, by the peculiar combination of circumstances requisite for its production ; and only a very small proportion of the cotton grown in the United States is of this kind ; nor is the quantity at all on the increase. In the year 1805, the export of the Sea Island cotton was 8,787,659 lbs., and in the year ending the 30th September, 1832, it was only 8,743,373 lbs. This cotton being, from the situation in which it is grown, much exposed to the inclemency of the weather, varies greatly in quality, the finer sorts bringing often three times the price of the damaged sorts."

The following sensible letter on the growth of cotton, by Dr. Mueller, was recently laid on the table of the Legislative Assembly of the Colony of Victoria, by the Hon. J. H. Brooke:—

"Melbourne Botanical and Zoological Gardens,
"18th April, 1861.

"SIR,—In compliance with your request, I have the honor of submitting to you some brief observations in reference to the contemplated culture of cotton for commercial purposes in Australia.

"From the well-established fact, that cotton is successfully produced in favorable localities, not only of the countries within the tropical and sub-tropical zone, but also northward as far as the border of the Mediterranean sea, in South Carolina, and Northern China, it may be inferred that through a great part of the Australian continent, and more particularly along its littoral tract, the cotton plant will find a climate most favorable to its development.

"Whether in the cooler temperature of Victoria the important commodity can be produced in such luxuriance as to render it available for factories, remains yet to be ascertained," judging from the fact that the mean annual temperature of the vicinity of Melbourne falls considerably short of that of most cotton-growing States, and relying on the somewhat isolated observations that a number of plants of the Sea Island cotton, grown in the Botanic Garden of Melbourne, failed to produce cotton, or ripened their seed-vessels only exceptionally or imperfectly. Since however, the northern part of our colony experiences a much warmer climate, although subject to great ranges of the temperature, and since the eastern part of Victoria, under the favor of an aerial and oceanic current from a wide tropical sea, enjoys a climate so mild that palms and several other types of tropical vegetation are observed to descend to a latitude nearly as far south as that of the city of Melbourne, we may feel justified in predicting a successful issue of any contemplated experiments to raise cotton in those more genial parts of this colony. And here I would draw special attention to the promising features which are held out for such enterprises by the basaltic plains along the Murray, and by the diluvial banks of the lower Snowy River, the Genoa, and other eastern streams of Victoria.

"In New South Wales the gossypium, has been proved to be very productive of fruit, at least as far south as Maitland; and even the mean temperature fixed for the cultivation of some varieties of the herbaceous cotton plant is almost at a par with that of Port Phillip, for it appears that the intense heat of the summer, (for instance, in Louisiana, Mississippi, and Alabama), under the favor of dew and frequent showers, is sufficient to ripen the cotton fibre in regions otherwise subject to frost during the winter.

"No doubt, however, can be entertained as to the perfect suitability of both climate and soil of tropical and sub-tropical Australia for supplying cotton in vast quantity to the commercial world. Extensive trap-downs (occasionally at moderate distance from available shipping places), and the alluvial deposits in the vicinity of the coast, and along many rivers, as well of Eastern as of Northern Australia, are equally inviting to the cultivation of the cotton plant.

"Moreover, even from Arnheimsland towards Central Australia, many tracts may at a distant period become available for the above purpose, as is sufficiently demonstrated by the fact that I discovered there, the true rice in a spontaneous state of growth, rice being usually concomitant as a cultivated plant to that of cotton.

"The climate of North-Western Australia, however, would in all probability prove too oppressive during the summer months to Europeans for field

labor, and it would probably be needful, to give impulse to any design of establishing cotton plantations in Arnheimsland, whenever that part of Australia will be re-occupied, by rendering labor from other countries of the torrid zone available for the purpose.

"But whilst it is pleasing to anticipate that Australia (at least as a whole) will offer to future colonists almost unbounded fields for adding cotton as one of the most important articles to her exports and to her manufacturing resources, it remains as yet to be shown whether, at the present price of cotton, the labor in a country so extensively aridiferous as ours can already be brought to bear on a competitive development of this important future source of employment, comfort, and wealth in this part of the world. Yet it must be borne in mind that some of the juvenile and aged portion of our laboring population would in the cotton field obtain that more easy manual work which neither the ingenuity of machinery can supersede, nor the task of furthering to the surface the mineral treasures of this country can readily and with equal certainty offer.

"It will, therefore, be a wise measure to give, as contemplated by Government, the utmost encouragement to the establishment of cotton fields wherever the soil and the climate appear promising, and to await meanwhile the results of experiments, which may possibly be more favorable for the practical solution of the labor question connected with the establishment of cotton plantations than has been hitherto anticipated.

"I have the honor to be, Sir,

"Your most obedient Servant,

"FERD. MUELLER,

"Government Botanist.

"To the Hon. J. H. Brooke,

"President of the Board of Land and Works."

I have to remark, in regard to the foregoing letter, that I do not construe it as being discouraging, inasmuch as the partial failure of the Sea Island plants in the Botanic Garden at Melbourne might have been feared, because, with the exception of the *hirsutum* family, the Sea Island variety is more particular in its climate and other requirements than any other gossypium. It will be seen by the foregoing extracts from Royle and Baines, which I have introduced purposely to vouch the pertinence of my remark, that, according to Royle, "the quantity [of Sea Island cotton produced] is limited, from the peculiarity of the physical circumstances required for its production;" and that according to Baines, "owing to the peculiar combination of circumstances required for its production, the quantity grown was very limited," even in its own peculiar Sea Island districts, so that the culture of Sea Island cotton had not increased during the twenty-seven years which had elapsed between 1805 and 1832. Probably the application of Mr. Seagrave's prescription of salt mud mixed with broken sea shells and sand, with some atmospherical protection, might induce Melbourne plants to ripen their seed and produce good cotton of even this variety. The experiment ought to be tried, at all events to an extent sufficient to mature a few plants for experimenting with.

Phillips, in his "History of Cultivated Vegetables," thus writes of cotton : "From Arahia it would naturally travel towards China, through all the countries which lie below the 40th degree of north latitude ; but as a species of the cotton plant has been found in the same latitude in America, it confirms the opinion that most plants spring spontaneously within a given distance of the poles, and that their varieties originate from the nature of the soil, or accidental impregnation from plants of a similar species." And Phillips adds that "Nieuhoff, who was in China in 1655, states that cotton grew in great abundance in that country, and was then one of the principal articles of its trade, the seed having been introduced into that empire about five hundred years previously ; and that Siam produced most beautiful cotton, of which hose and other articles were manufactured, exceeding even silk for lustre and beauty, the seed of which silky cotton had been sown in the Antilles, where the plants flourished, and yielded this delicate floss in abundance." "Calico, or cotton cloth, is so called from Calicut, a city on the coast of Malabar, where the Portuguese first landed on their discovery of the India trade route."

"A considerable number of varieties of cotton (says the editor of a Cyclopædia published by the Society for the Diffusion of Useful Knowledge) is certainly cultivated, although little is correctly known about them. In some of them the cotton is long, in others it is short ; this has its seed white, and that nankeen-colored. One may be cultivated advantageously where the mean winter temperature does not exceed 46° or 48°, and another may require the climate of the tropics. This is just what happens with all cultivated plants. Some vines will produce only sweet wine, others only hard, dry wine, and some are suited only for the table ; some potatoes are destroyed by a temperature of 32°, while others will bear an average English winter. Only one kind of wheat produces the straw from which the fine Leghorn plaits for bonnets is prepared. But to multiply such instances is unnecessary. There can be no doubt that the quantity of cotton will depend upon climate, in part, and upon the specific properties of different varieties, also, in part."

"Brazilian cotton (says Chambers, in his Information for the People) was first imported in 1781. Pernambuco cotton is very valuable, generally fetching a price next to that of Sea Island. The value of cotton for manufacturing purposes is reckoned by the length, strength, and fineness of the staple or fibres. The 'long stapled' or more valuable cottons are Sea Island, Brazilian, West Indian, and Egyptian ; the 'short stapled' or inferior qualities are the upland cotton of America, the Orleans, Mobile, and Surat cottons."

I shall take my example of European cotton culture from the husbandry of Sicily, a country which much resembles the colony of Victoria, both in its climate and its soil. The variety of cotton which is there cultivated is of the herbaceous species, which being sown in March, begins to flower in July ; healthy plants are stated to rise from three to four feet in height.

The seed is sown in lines three feet distant from each other, in clusters of half-a-dozen in a place two feet apart in the lines, and the plants are afterwards thinned to the strongest in a place. The land is irrigated once or twice a week, by means of furrows between the rows. The flowering season is usually over by the middle of September, and then the ends of the shoots are pinched off, in order to determine the sap to the capsules, which are subsequently collected by the hand as they ripen. This tedious process generally lasts until the end of November. The cotton and the seeds are then separated by manual labor, the cotton being packed in bags for sale, and the seeds being either bruised for oil or eaten, being considered both wholesome and nutritious. The cropping rotation of the Vale of Loreto, near Vesuvius, which is somewhat celebrated for its cotton farming, runs thus:—1, maize; 2, wheat followed by beans, which ripen in March; 3, cotton; 4, wheat followed by clover; and 5, melons followed by French beans, thus yielding eight crops in five years. As water is commanded in the vale, it is distributed, as in Tuscany and Lombardy, to every kind of crop. The course of cropping might be bettered by extension, and the information would have been more satisfactory to me, had it been explicit as to whether the seed was consumed as human food or by cattle.

The following extracts, from the reports of the East India Company, throw light upon eastern cotton culture; and I give publicity to them now, along with the foregoing authorities, in order that, until Australian cultivators can have fuller details than I am at this time able to present, they may not be wholly without the experience of the past to guide them in the coming emergency. The series may be considered as well illustrating the progress of a very persistent though unsuccessful attempt by the Company to cope with the southern states of America in the production of cotton for the English market. My object in their selection from a scarce book of 431 pages being to describe the progress of Indian cotton culture, from its revival in 1788, in the language of the parties concerned in it, with the view of applying Indian experience to Australian benefit.

In a letter from the Court of Directors in England to the Governor-General in Council at Bengal, the Company thus write in 1788:—"We earnestly call your attention to the article of cotton, with a view to affording every encouragement to its growth and improvement in general, but particularly to the species manufactured into the finer sort of thread in use for the superior goods of the Dacca fabric, as we learn that many of our orders for those assortments have not been able to be executed for want of such fine thread.

"We have, in compliance with the wishes of the manufacturers, come to a resolution of importing 500,000 pounds weight of Broach and Surat cotton, or cotton of the produce of Bengal of a similar quality; you will, therefore, concert with our servants at Bombay the means of carrying this resolution into effect, and furnish us with every needful information respecting the article, as to its growth, quality, cost, the quantity which is capable of being procured for exportation, the political and commercial effects that

would arise from such exportation, and any other particulars you may deem it necessary we should be informed of."

The following account of the cotton used in the cloth manufactures at Surat is extracted from a letter written in 1790, by the Governor in Council at Bombay to the Governor-General in Council at Bengal:—"Cotton is produced from seed, and throughout this country the seed is nearly the same in quality. Only one kind of cotton is used in the cloth manufactures, but this varies considerably in value according to the part it comes from, the difference arising in a great measure from the soil, and also, in some degree, from the manner in which the cotton is extracted from the pod. This last reason particularly affects and lessens the value of the Bownaghur cotton, it being always more full of dirt and leaf than that of any other part, and the soil being poorer the bacas grow much smaller.

"The seed, which is usually put into the ground as soon after the first fall of rain as the earth is sufficiently softened to be easily cultivated, is sown in straight lines and as regular as possible, so that the shrubs may shoot up single and about a foot asunder. The ground is kept well weeded, and (except a sufficient moisture to soften it, so that the young roots may easily strike downwards) free from the water, carefully allowing none to lodge on the surface, it being pernicious both to the seed and shrubs. Cotton is seldom sown after the end of August in and about the Guzerat, from the great uncertainty of having sufficient rain at the time when the shrub most requires it. When the shrub is well advanced and strong, it requires no other moisture than the dews, which fall very heavy in this part of the country as soon as the cold season sets in, which is about the beginning of November. In three or four days after the seed is sown the shrub makes its appearance, and in five or six bears two leaves.

"In November and December the bud appears, which flowers in four or five days. The flower after continuing about the same time falls, and the pod appears, which ripens in about twenty-five or thirty days, but requires both sun and heavy dews to bring it to perfection. When ripe it bursts open on three sides and discovers the cotton. Five or six days after the pod is open the cotton is ready to gather, but may remain upon the shrub for ten days without injury.

"It is customary here to gather the cotton ten days after the pod opens, and then allow ten days more for other pods to ripen, and so continue gathering as they come forward till the month of April, by the end of which the cotton is all off the ground. The cotton that is taken from the shrub the first and second time of gathering is the finest, and it afterwards gradually diminishes in quantity, as the vigor of the shrub becomes more and more exhausted. At the season for flowering and budding, the sun and dews are much required, cloudy and rainy weather destroying the crop.

"Cotton ought not to be sown two succeeding seasons in the same ground, though it does not injure the ground to sow grain of different kinds, such as do not, like rice, require much water in it; yet, letting the earth be fallow one season, having it well cleared of weeds and roots, and thoroughly opened so as to imhbe the rains, much improves it, and makes it yield a

good crop of the finest cotton the next year, provided the season is not unfavorable. Among the poorer planters it is customary to sow cotton every year in the same land, but it generally lessens the crop considerably, both in quality and quantity.

"The seed for planting must be thoroughly cleaned of the cotton, which is generally done in this country by rubbing it over a cott, close and well strung with coir, the cotton and bad seed remaining on the cott, and the good seed falling through.

"Seed for transportation to other countries should not be separated from the cotton, but covered with it, be put into dry sweet casks, and placed in a dry part of the ship or vessel conveying it, not in the hold, as the heat will be too great and the air foul, nor exposed to wet or damp air, but in an open, airy, thorough dry situation, and it will in that state preserve for two or three years. If separated from the cotton it decays in a short time; and moisture, of course, occasions a premature vegetation. The cotton is cleaned of seed by small wheels, and the seed, when extracted, is used for sowing and feeding cattle."

Remarks on the culture of cotton at the Island of Bourbon, in 1811, state that "the cultivation of this valuable plant in this colony is of recent date, and has only been followed since the years 1788 and 1789. Towards the year 1796 the plant began to degenerate, and a greater quantity of cotton was produced of a yellow than a white color. This was at first attributed to a want of rain, and afterwards to the impoverishment of the soil. But observations and experience has since shown, that the cotton, shortly after flowering, was pierced by an insect which deposited its eggs in it; for in the yellow cotton a blemish is constantly found, apparently caused by the animal, which alters the color of the wool, and occasions its appearance before the time required by the nature of the plant.

"Cotton thrives best in warm low grounds. too much rain is hurtful to it, not only because excess of vegetation prevents the tree from producing so great a number of pods, but also from the injury sustained by the wool from the wet. Strong grounds suit cotton pretty well, and it succeeds tolerably well also on sloping grounds. Flat, free, and too rich soils, particularly those which retain humidity, have been found little suited to this culture. The shrub flourishes luxuriantly, the leaves and pods become formed, the former are large and of a dark green, but the tree produces little fruit. These observations are often made at Bourbon where the nature of the soil is much varied.

"Sandy mixed grounds of vegetable earths are very proper for the culture of cotton: it thrives there admirably, supports droughts easily and lives to a great age, although harassed by the axe, storms, and bad weeds.

"It is a common saying at Bourbon, 'no esquine no cotton.' This assertion is well founded, for a few years since the esquine had given place to a very thick kind of dog-grass, of which the fibres multiplying to excess necessarily smother those of the cotton-trees.

"The branches of the dog-grass are covered with small brittle leaves, which the wind takes off, and which stick to the husks of the cotton. If

the husk fall it is soiled by these bits of grass, which increases the trouble of cleaning. The esquine, on the contrary, has a smooth elevated stem. Its leaves do not come off, and its flower is neither in a branch downy or bearded, inconveniences which are found in many herbs from which it is necessary to cleanse the cotton tree. Its roots are remarkable, inasmuch as they do not extend beyond an inch, so that they cannot in the least incommode those of the cotton tree. In fine, the esquine has the advantage of forming a carpet, which covers the soil and protects it from the heat of the sun, and receives the husks which fall without soiling them. We have also at Bourbon the custom of planting peas in the cotton-grounds, which offer the same advantages as the esquine, and moreover procure a useful pulse in domestic economy."

"At Bourbon they cultivate two kinds of cotton; one with a black smooth seed, easy to detach from the wool, and for this reason most esteemed. It results from this property, that the milling and cleaning are quicker, for crushed seed forms the principal dirt of the milled cotton. The silk of the cotton with black and smooth seed is inferior to that with white seed. This last kind is softer and more delicate; the difference is perceivable to the touch: the other is more rough, and gives way less easily under the pressure of the band. But the cotton with white seed is much more difficult to cleanse from it."

"When the cotton-plant has reached the height of an inch, and the seminal leaves have generally made their appearance, it is necessary to inspect the rows, to replace the seed in those holes where this may not have taken place. When the plants are three inches high, the number in each hole must be reduced to two; unless it be apprehended that either of the two may die, then three or four should be left. Whilst the plant is young great care must be taken to keep it clear of weeds, that it may not be impeded in its growth. If the cotton-tree has been planted in November or December, it bears in six or eight months; if in winter, it is more backward, and only produces in May or June. Until that time it requires nothing more than clearing from weeds. Its greatest produce is at eighteen months or two years. It is gathered between the months of June, August, and September. It has been known to produce a few pods in October and November, and some trees have sometimes after their great crop, given a small one in the month of May following; but at this period, as after September, it is a mere gleanings. When the cotton-tree is in its greatest vigor the weeds do not appear to affect it much."

"At Bourbon, about the month of April, the cotton-tree begins to shed its leaves. This fall precedes the blossoming; fifty days after which the gathering begins. The blossoming varies from a month to a month and a half; but, in general, the earlier it takes place the more abundant is the crop. The earth should not be hoed when the pod begins to open, lest the dust should soil the wool."

"The dry soil, and climate of Guzerat," (say the Governor and Council of Bombay, in a communication to the Court of Directors, in 1812,) "are very favorable to the cotton-plant, for it is found to grow in the most sterile

districts, though less luxuriously; and the great demand and consequent high prices given of late years, have contributed much to the more extensive cultivation of the commodity, particularly further to the northward.

"The cotton-seed at Surat, which is all of the *black kind*, is sown annually in drills, at the distance of about one foot between each plant, after the first rain (say in July), the ground having been previously well cleaned and all the roots of the former crop carefully grubbed out, after which it arrives at maturity without any further care. Ground which has been one year in fallow is always found to produce more abundantly.

"There are three gatherings of cotton in one season. The first commences from the middle to the end of February, and yields always the finest wool, being the pods taken from the tops of the shrubs; the second, fifteen days later, is inferior; and the third inferior to the second, and is pulled from the lower part of the hush."

"With regard to rearing cotton on Salsette, it will appear from a report from the collector on that island, that they entertain no doubt of their being much land on Salsette which, according to the description contained in the printed directions forwarded by your Honorable Court, is well suited for the cultivation of cotton, as all the soil in the hilly districts seems to be of that nature; that Bourbon plants of cotton are partially flourishing in hedgerows and elevated spots where the earth is free, but notwithstanding this favorable circumstance, every attempt that has been made to cultivate this production on Salsette has failed. Dr. Scott, a proprietor of land in the island, had once many acres in cotton, but after a few years he gave up the cultivation; and they have been given to understand that it has since been tried by the late Ordusee Dady and Hormasjee Bomanjee, also proprietors of land there, who have both expended much money with no better success."

"These failures are attributed to the same cause as those which have rendered many of the agricultural speculations in India abortive. The Hindoo laborer will never yield any adequate return for his wages when employed in agricultural concerns, even with the utmost vigilance of the farmer. The severe labor of working the soil, and every other duty incident to this calling, require a very strong interest to induce that attention to it which is absolutely necessary. This is entirely wanting in the day-laborer; nor is there any circumstances in his connection with his employer which gives him motives either of sympathy or dependence, which might excite in him sufficient attention to the work he is engaged in."

"There are two species of the shrub-cotton," (writes Mr. Bernard Metcalfe, an agent of the Company, in 1815, who had resided several years in Georgia and New Orleans, and had been sent out to instruct the Hindoos in cotton-cleaning, market preparation, and management, as practised in the American States) viz.: "The black and the green seed, in each of which there are, probably, as many varieties as of the gooseberry or any other shrub. The black seed is only cultivated in the West Indies and the Brazils, because the labor required in separating the cotton or staple from the seed is neither so difficult nor so tedious as the green seed. The cottons grown in India are for the most part a variety of the green seed, of which

some are more easily cleaned than others. Those that may be regarded a staple commodity of the country are principally found in the Company's possessions, in the Gnzerat and the Broach, in the Maratta dominions, and the Ceded Districts of the Nizam: they are likewise cultivated to a considerable extent in the province of Bundelcund and the Rohilla country, as well as in the Southern Districts of the Peninsula. In fact, the cotton-plant is indigenous in most countries within the tropics, and cultivated in much higher latitudes, neither requiring a very rich, nor impoverishing a lighter soil. It has this singular property, of producing the finest staple where the waters are brackish. The Georgia Sea Island, the Surinams, and Demeraras are all grown on the border of the sea, and the prime qualities only as far inland as the influence of the sea-air and tide-waters extend. I have often regretted not having the means or opportunity to ascertain how far the lands in that great delta of the Sunderbund, and particularly the provinces adjacent, which after the secession of their waters during the eastern monsoon are so strongly impregnated with salt, would not produce cottons of an equally fine texture with those above-mentioned, and which in England always bear so high a price. The presumption is, the attempt would be successful, provided the black seed was procured from Demerara or Georgia.

"The cottons grown in the Ceded Districts are a variety of the green seed, to which they adhere with great strength, and are in consequence difficult to clean. The capsule and seed are both small, and the fibres of the cotton have the appearance of having interlocked in their growth. In confirmation of this, the American saw-gin sent out by the Company to Madras, which was imported from Charlestown, and no doubt constructed there by a regular gin-maker, and competent to cleaning the bowed Georgias, would not when the attempt was made to clean with it the district cottons, discharge the seeds, but became immediately choked. In fact, it was observed, those I had built on the same principle succeeded much better. But it was not from the introduction of any new machinery, but rather the improvement of that already in use, more particularly by introducing greater precautionary means in the first stages of its manipulation, the gathering in from the field (or as the Americans call it the picking), that I grounded my hopes of any improvement of the district cottons: for their principal deterioration is less from the quantity of seed in them, than their being specked and fouled with broken leaf. Any improvement of the cottons at present cultivated, after the experiments that have been made, it is evident must be by resorting to these means; and even then will only be limited, for the cottons generally throughout India are of so short a staple that with all the care that can be given them, they will never have a much higher character. A more effectual improvement would no doubt be to send them the seed of a new and different variety of the plant."

The following account of an early experimental planting of Bourbon cotton on the peninsula of India is interesting to young beginners in the same line:—

"The spot selected for the trial was chosen from its local convenience for

superintendence; the soil a sandy loam, the general character throughout these districts. It afforded the means of irrigation; but these were not availed of, as it appeared desirable to ascertain the product of the soil without such assistance, which would have added very materially to the expense of cultivation, independent of the difference of rent of the land, which, if possessing means of irrigation, averages ten rupees per begah; if not, four rupees per begah is a fair estimate. The seed was sown in rows, distant three feet from each other, preserving the same distance of plants in each row. The sowing commenced at the end of July, 1816, after the first heavy rains were over. Bejaree was sown by drill, in the usual manner, at the same time with the cotton. The sowing of Indian corn with the cotton is recommended at the Isles of France and Bourbon, as affording protection to the tender plants from the heat of the sun until the grain be ripe, by which time they have acquired sufficient vigor. In the present case the bejaree answered the purpose equally well; and as the plant yields no return the first season, the crops of bejaree ought to pay the expense of rent and cultivation.

"The after-rains of 1816 were very scanty, and the plants remained in an apparently sickly and dwindled state until the rains of 1817, when they put forth most luxuriantly; so much so, that it was found necessary to remove every alternate plant, which left a space of six feet between each: still they were subsequently too crowded. I think eight feet would be a good distance. The flowering commenced early in September, and the cotton began to ripen in November. The gathering of the first crop was finished by the middle of January: a second crop may be expected in the month of May, but I imagine a very scanty one. Opinions are divided on the Island of Bourbon, whether the plant should then be cut down or simply left to the operation of nature. The preference can only be decided by experience, and I would, of course, recommend that one-half of the plantation be pruned, leaving the other to its natural state.

"There are two kinds of cotton cultivated in Bourbon; one producing a black seed, which is very easily detached from the cotton; the other a *white*, adhering so firmly to the staple, that the latter is torn from it, leaving the ends of its fibres in the seed, which gives it the white appearance. No sample of the white seed has been hitherto received. The culture of cotton has been introduced in the Islands of Bourbon and Manritius within the last thirty years. It would be desirable to know from whence the seed was originally imported: in all probability it came from some of the French West India Islands. It is not unreasonable to infer, that the Pernambuco, Sea Island, and other superior descriptions of cotton, might be successfully cultivated in this province."

"The cotton at present cultivated" (writes Mr. Randall, of the Company's service, in a memoir upon cotton culture, in 1819), "in the territories under Madras is not, generally speaking, of the best kind: much of the old native cotton is poor in produce and bad in staple. The most saleable cotton-seed for India would be from New Orleans, Brazil, and Bourbon, being the most profitable kinds of cotton, white in color, long stapled, and pro-

ducing the most wool from the pods, also the easiest cleaned from seed and the least troublesome in cultivation. These seeds, however, require after planting the nourishment of water during the hot months, and should be watered twice every week. Even the Surat and Ahmood cotton-seeds, for a change, would be better than what at present are used, which seem exhausted or worn out. In agriculture, it is well known that a change of seed is very beneficial in increasing both quantity and quality. The musters of cotton and seed sent with this paper are the produce of Brazil, or what is called kidney cotton, and Bourbon. Bourbon seed may be planted between small ridges of soil in open field, if the fields can be watered by wells, tanks, springs, or nullahs branching from large streams. The Brazil or kidney cotton is a tree which grows from ten to twelve feet in height, and which produces an immense number of pods, having the finest wool enveloped about conglomerated seeds, each pod having from six to ten seeds so conglomerated. This kind of cotton will succeed and thrive well on the banks of tanks, nullahs near springs, wells, and small streams of water: it is a very valuable kind of cotton. When the seeds are to be planted they are of course to be separated, so that each pod will produce six or ten-fold only in plants."

"The pods of Brazil cotton are large; the cotton separates easily from the seeds; the wool is very close enveloped round the seeds, thereby preventing pieces of leaf and dirt obtaining an easy entry. The Brazil cotton-tree is hardy, and after being exhausted makes good fire-wood. It lasts about seven years from the time of planting, and, when well up, is not easily injured by weeds; but it requires watering certainly twice in a week during very hot weather; in the rainy season it requires little or no attendance: it should at times be pruned of dead wood. I conceive from 500 to 600 plants will rise well upon an acre, and when full grown will produce each tree not fewer than five or six hundred good pods. I have myself counted even a thousand pods upon a large tree; but in all calculations it is best to be moderate, as least likely to deceive; I have, therefore, calculated only five hundred plants upon an acre, each full grown plant to yield five hundred pods. Two hundred and thirty pods, in general, will make a pound weight; and when the wool is separated from the seed, the produce of fine clean cotton is from one-quarter to one-third of the weight of every pound gross, cotton and seed. The muster now sent containing pods of Brazil cotton was actually planted and reared by myself. When I weighed thirty-six pods of the Brazil produce, the gross weight was 887 grains. After separating the wool from the seed, the wool weighed 234 grains, the seed 653 grains, not a particle of leaf or dirt in it. Thirty-six pods of Bourbon weighed gross 294 grains. After separating the wool from the seed, the wool weighed 80 grains, the seed 214 grains. Thus, it seems, Brazil cotton produces about twenty-five or twenty six per cent. wool; Bourbon twenty-seven per cent. Mr. Metcalfe found that old native cotton produced only twenty-two per cent. of wool: and he declared, justly, that it cleared or separated most tediously, and was quite a vexatious proceeding. But the most remarkable circumstance is, that old native produce is not more than 30 lbs. of clean cotton an acre. So small a produce has always surprised me, and caused a

suspicion that my information was not correct; yet, after every enquiry, I have not been able to find a better result. The Brazil cotton is about, taking the lowest calculation, seed and wool 1085 lbs. an acre, or $27\frac{1}{4}$ lbs. clean cotton free from seed; perhaps Bourbon may produce something more or less, depending upon how the shrubs come up, and thrive. To suppose that the natives of India, of themselves, will undertake any new scheme, is contrary to long and wide-spread experience. They are the children of very inveterate customs and prejudices."

"As to reasoning with them about the benefits of any new system or scheme, except in a very few instances, it is a vain attempt and a mere waste of time. They will coolly listen to such conversations, and then they will start the most absurd objections, give innumerable excuses, talk about their old customs, express dislike to innovation, laugh at the idea of increasing what is called by Europeans their comforts, and at last go away determined not to try anything new."

Among memoranda, on the culture and trade in cotton, in the East Indies, made in 1828, are the following statements, "The cotton shrub is indigenous throughout the peninsula of India, from Ceylon in the south to the foot of the Himalaya mountains in the north, and various kinds have long been known to the native cultivators, viz. annual, biennial, and cotton of several years' duration. Some kinds scarcely reach the height of one foot, others attain ten or twelve feet, and some a still greater height. The species which is most generally, indeed it may be said universally, in cultivation in India, is an annual shrub, a variety of the green-seed kind, yielding a white pod; but even of this variety there are many sub-varieties, of some of which the wool is more easily separated from the seeds than of others. There are, likewise, cotton-plants with brown, yellow, ash-colored, and iron-grey pods. Some of the species have black seeds, some green seeds, and there is cotton found with red seeds.

"The introduction into India of new and better species, and of improved modes of preparing cotton for the European markets, has at various times during the last thirty years engaged the attention of the Court of Directors and of the Indian Governments, and also of the private residents, and the following kinds of foreign cotton, and probably others, have become objects of experimental cultivation in various parts of India, viz., Sea Island cotton, Barbadoes cotton, Brazil cotton, Bourbon cotton (both of the green-seed kind and the black seed varieties), and cotton from China.

"It would be matter of gratification, if it could be said that success had attended these endeavors, but the native cultivators do not appear to have given any or at most very little attention to the subject."

"The delicate fabrics of Dacca were at all times manufactured entirely from the cotton of that district, which is the finest of all the cotton produced in India, and is probably the finest in the world; but the growth of this particular kind of Dacca cotton is limited to a space of about forty miles in length by less than three in breadth, along the banks of the Megna, about twenty miles north of the sea. An attempt was made in the years 1790 and 1791 to encourage the cultivation of this species of Dacca

cotton in the other parts of Bengal, and the collectors of the revenue, with the residents at the commercial factories, were directed to distribute the seeds amongst the native cultivators; but the endeavor failed of success."

"Besides the general defect of shortness of staple, Indian cotton is liable to objection on account of its not being sufficiently cleansed from the seeds, leaves, and other matters. To remedy which the Court of Directors obtained from America patterns of the most approved machines in use in Georgia and Carolina, for separating the wool of the cotton from its seeds; and they also, in the year 1813, engaged the services of Mr. Bernard Metcalfe, but this person, after residing in India some time, finding that his endeavours to induce the natives to use American machines were fruitless, gave up the employment and retired from India altogether."

"We are informed," say the Court of Directors, in a communication to the Governor-in-Council at Bombay, in 1829, "that at least three-fourths of the cotton which is manufactured in Britain is the produce of Georgia and New Orleans, in the United States of America, being known in mercantile language as Georgia upland cotton and New Orleans cotton, and is exclusively the wool of the species of cotton which produces a green seed; and we are further informed, which is exceedingly material in the present consideration, that the Bombay cottons, particularly those of the growth of the districts near Surat and Broach, are little or nothing inferior to the upland American descriptions above named, the item of cleanness alone excepted, and that such Indian cotton might readily be brought into competition with the upland American. We are aware that it has been stated in a letter in your commercial department, that the seed of the cotton which is cultivated near Surat is black; but as the cotton usually grown throughout India is almost universally of the green-seed species, and we find that the seeds which are very commonly intermixed with the cotton imported into London from Bombay, are also green, we think it probable that your information may not have been correct on this point. But whether the seed of the Surat cotton be green or black is of secondary importance, as the produce which it yields, when carefully prepared, is much esteemed in the British market."

"Experience has convinced us, that the improved cultivation of Indian cotton, so as to render it fit for the British market, will not be effected merely by the countenance and occasional encouragement of Government; we have therefore resolved, that an experimental plantation for cotton shall be established, at the expense of the State, within the territories under your authority. The manner of carrying this into operation we are disposed to commit entirely to your judgment and local knowledge. It appears, however, that it will be advisable, in the first instance, that a piece of ground, either in the possession of Government or to be hired for the purpose, should be selected in the most suitable place that can be found, (say to the extent of perhaps two hundred English acres,) and that a person, either native or European, of competent skill in this branch of agriculture, should be entrusted with its management at a moderate salary,

under the general superintendence of the collector of the district, or the magistrate, or the commercial resident, as you may appoint.

"The first object to be attempted should be careful cultivation of cotton raised from seed of the best of the indigenous plants of India, such as the Bhyratta kupas of Bengal, or the best kinds at present grown about Surat or Broach, which will give sufficient employment for the first season; and before a second season shall arrive we will endeavor to furnish you with a supply of green seed from Georgia and New Orleans, which you will afterwards cultivate exclusively, or in addition to the native kinds, as experience shall render advisable."

"We have before shown, that the cleaning of the cotton from its seeds and impurities is a point of nearly equal importance with that of improving its staple. Upon a former occasion we transmitted to India machines for cleaning cotton, of the best construction at that time in use in the United States of America, and we also engaged the services of a person who had long resided in Georgia and was skilled in the use of them, but the object failed of success. We understand that the excellent condition* in which American cotton is now brought to market, is owing to the almost exclusive use of a machine of more modern invention, called Witney's saw-gin, which is represented to be so simple in its construction and so easily worked, that the cleaning of the cotton, which was formerly performed by separate tradesmen, is confided to the management of slaves.

"Although it is our desire that your attention should be chiefly given to the improvement of the native cotton, which we have particularly specified, and to the introduction of the upland American cotton, we see it right to suggest to you the expediency of further attempting, on a small scale, in different parts of the territories under your government, the cultivation of all the finer sorts of foreign cottons in different situations as to soil, and particularly in districts bordering on the sea-coast.

"We shall endeavor to procure various kinds of cotton-seed and transmit them to you for this purpose."

"My attention," writes Mr. Henry St. John Tucker, a member of the Court of Directors, in a valuable paper on the supply of cotton from British India, communicated to a committee in 1829, "has lately been called to the important question of extending the importation of cotton-wool from British India, both with a view to the great national object of rendering Great Britain, as far as possible, independent of foreign supply, in the first instance, of a raw material, upon which her most valuable manufacture depends, and also with a view to add to the agricultural resources of India, and in so doing, to facilitate the means of remittance from our extensive possessions in the East, which incur annually a political and commercial

* "The American cotton is not only free from any admixture of seeds, but is also divested, in the most complete manner, of broken fragments of the pods and other extraneous matters, as well as of discolored and damaged heads. Indian cotton, on the contrary, is greatly mixed with both."

debt to the mother country. I shall therefore submit, in a summary way, the results which I have been enabled to obtain by consulting the public records, and by personal communications and correspondence with those individuals (Dr. Wallich, of the Botanic Garden, and others,) who appeared to me likely to possess the best information on the subject.

"1. There are two species of the cotton-plant producing the wool which is used in our manufactures; the *gossypium Barbádense* and the *gossypium herbaceum*: and there are persons who maintain that an essential difference exists, not merely in the botanical character of the two species, but in the strength and durability of the filament which these plants produce. It is well known that the *gossypium Barbádense* is grown generally in America and the West Indies, and may be designated the cotton of the West, while the species *herbaceum* is a native of Asia, and may be distinguished as the cotton of the East.

"2. There are several varieties of each species, produced probably by a difference in situation, soil, climate and culture; and although the two species, with their several varieties, have an original and natural site, there is reason to believe that they can be cultivated indifferently, in any tropical situation favorable to the production of the plant generally.

"3. The cotton of the West, as the raw material of our manufactures, has hitherto borne, and still bears, a much higher price in the markets of Europe than the cotton of the East; although it is contended, that the fabrics woven from the latter surpass, in the essential character of strength and durability, those which are manufactured from the cotton of America.

"4. Without insisting upon the superiority of the eastern cotton as a natural production, its inferiority as an article of commerce, and its consequent depression in price, may be accounted for by the following circumstances, which operate in a greater or less degree in deteriorating its quality and merchantable value.

"First. The best variety is not generally cultivated for exportation.

"Second. The best situations are not always chosen for its cultivation.

"Third. The mode of culture is essentially defective, the natives of India being in the habit of growing different articles of produce upon the same land at the same time, with little regard to a rotation of crops; and owing to this injudicious husbandry, and to carelessness and mismanagement in other respects, the shrub, which under proper care is elsewhere rendered biennial, triennial, and even perennial, is in India found to be an annual only.*

"* By some authorities it is considered judicious husbandry, to root up the plants every second or third year, and to change the seed periodically. The natives of India, where the plant is an annual, rarely, I believe, take the precaution to procure seed from other quarters, although this is known to be beneficial, both in rural economy and in horticulture. Where the cotton plant is biennial or triennial, it is said to yield the best produce in the first year, and so far the Indian cultivation may be right in allowing the shrub to die off annually; but it still may be highly useful to change the seed and to practice a more useful husbandry.

"Fourth. The cotton is not properly cleaned and separated from the seed ; the machinery employed for this purpose being very insufficient, and greatly inferior to that now in use in America.*

"Fifth. In consequence of the defects in the machinery, the essential oil of the seed is liable to be expressed and suffused over the cotton, to the injury of its color and quality.

"Sixth. The cotton being produced generally at a great distance (in some instances not less than a thousand miles) from the place of export, and the state of the rivers at the season of gathering the crop not admitting of its being conveyed the whole distance by water, it is frequently warehoused for months at intermediate stations, and a whole season is often lost before it can be packed and screwed for exportation.

"Seventh. During its progress to the place of export in loose bags or bales, partly by land and partly by water, it is much exposed to the inclemency of the weather; the bales are often rendered wet or damp † by the heavy rains which prevail in tropical climates, and the cotton seldom arrives at its place of destination without some discoloration and partial damage, incidental to its conveyance in open carts and ill-secured boats, during a long land journey and tedious river navigation.

"Eighth. Although attempts are made to clean the cotton, and remove the seed and particles of the pod and leaf, before it is submitted to the screw, this is never done effectually, and the extreme compressure to which the cotton is then subjected by this powerful machine, with a part of its seed and impurities still adhering, must tend to injure the fibre.

"Ninth. The heat and moisture of the hold of a ship during a long voyage, in which great alternations of temperature are usually experienced, may also tend to injure the quality of the article.

"Lastly. It may be observed, that the practice heretofore common in some of our provinces, of receiving the cotton in payment of rent and revenue, was calculated to make the cultivators more solicitous to increase the *quantity* than to improve the *quality* of the article. Their necessities, moreover, may be supposed to have compelled them often to gather their crop *unseasonably*, for the purpose of making these payments in kind ; and it is well known that cotton gathered in wet weather is liable to be materially deteriorated in quality and value. The practice of receiving payments in kind has been discontinued at Bombay ; but effects are often felt long after the original cause has been removed.

* It has been urged, that the saw-gin tears and injures the filament, and so perhaps it does ; but although hand-picking is very essential to aid in cleaning the cotton, it cannot become a substitute for machinery. In India, where labor is so cheap, the process of cleaning the wool ought to be well executed ; but the chnrker (or cylinders) used for separating the wool from the seed is a very rude machine, and leaves much to be done by the hand.

† It has been alleged, that the natives sometimes 'damp' the cotton in order to increase its weight ; but the defect may be referred, with greater probability, to other causes."

"5. Without assuming the superiority of the Eastern cotton as a natural production, the greater degree of strength and durability of the fabrics made from it may be referred, perhaps, to the following circumstances.

"First. The thread spun with care by the hand is probably more perfect.

"Second. The operations of the loom, when conducted carefully by the hand, are not so liable to injure the fibre as the process carried on by machinery.

"Third. The process of bleaching the brown web is effected in India by steam and the solar ray, and the texture of the fabric is not liable to be injured by the use of muriatic acid or other chemical solvents.

"Fourth. The fabric, for the purpose of being rendered more even and beautiful, is not exposed to the very delicate operation of singeing off the ends of the thread and other excrescences.

"Fifth. The raw material is not economized in our Eastern manufactures in any way to diminish the firmness and strength of the texture.

"6. The *Bairati kupas*, the finest variety, perhaps, of the Eastern cotton, is produced only in small quantity in the districts north-west of Dacca, and is never exported, I believe, as an article of commerce. Its favorite site seems to be the high banks of the Ganges (or as it is called in a part of its course, the *Pudnah*), and its tributary streams; but as the country adjacent is liable to annual inundation, the tract of land applicable to its cultivation is not extensive.* This variety, which is also called by the natives *Déey* (of the country), would seem to be as the name imports, the indigenous cotton of Bengal, producing those unrivalled fabrics, which have been known and highly valued in Europe from the earliest period of authentic history.

"7. Other varieties (the *Boghà kupas*, &c.,) are found in Bengal Proper, and are used in its domestic manufactures; but the cotton which is exported to Europe and China from Bombay and Calcutta, under the denomination of *Surat* and *Bengal*,† is produced chiefly in the tract of country lying between the rivers Jumna and Nerbudda, and extending westward to the Gulf of Camhary. Cotton is also grown in the southern

"* Many years ago I resided in this part of the country, and was induced, from the great superiority of the *Bairati kupas*, to send the seed, with a model of the *churker*, to my native island (Bermuda), but the cultivation of cotton was not prosecuted in that island. The fibre of the *Bairati* is extremely fine, silky, and strong, but the staple is very short, and the wool adheres most tenaciously to the seed. I have in my possession a specimen of the thread, which has been above forty years in this country, and is apparently still perfect.

"† The cotton exported from Calcutta as *Bengal*, bears a great variety of names on the spot (*Jalson*, *Kineb*, *Banda*, *Cuchaura*, &c.) derived from the place of growth or the principal marts to which it is brought for sale; but although the quality is very different, owing to a difference in soil, culture, and management, the cotton is all, I believe, of that description which Dr. Hamilton Buchanan designates *hill cotton*. The cotton of *Surat* differs from it only in consequence of the difference in local circumstances.

parts of the Peninsula, and is exported from Madras under the denomination of *Tinnevely*; but the quantity produced is not very considerable, and the strong durable fabrics manufactured in the Northern Circars are made from cotton obtained from the territory of Berar and the neighboring districts. I may add, that attempts have been made to cultivate cotton on the Malabar coast, although it is understood that they were not attended with such success as to lead to a belief that the situation is favorable for the growth of the article.*

"8. An experiment was made a few years ago, under the auspices of Lady Hastings, to introduce the cultivation of two varieties of the Western cotton (the Barbadoes and Brazil), at a place called Futteghur, in the vicinity of Calcutta; but although the cotton produced was reported to be of good quality, the experiment was upon too small a scale, and bore too much the character of mere garden cultivation to furnish any decisive result. It may be observed at the same time, that the thread spun from this cotton was not considered by the Indian manufacturers to be by any means equal in quality to that obtained from their own native cotton, it being estimated by them at eight† and ten per cent. below the value of the latter. This would seem to favor the notion that there is an *essential difference in the fibre of the Eastern cotton*; nor can it be disputed that the Asiatic fabrics,‡ from whatever cause, are superior in strength and durability to the manufactures which are produced from the cotton of America.

"9. The *Bairati kupas*, although its fibre be fine and silky, and admirably calculated for the manufacture of the muslin or thinner fabrics, has the disadvantage of a short staple, while the wool adheres so closely to the seed that it is with difficulty separated; and this variety is otherwise, perhaps, too costly a production to enter largely into our manufactures.

"10. Although some of the finest cotton is produced in islands and situations within the influence of the sea, this circumstance does not appear to be essential to the perfection of the plant, since a large portion of the

"* Attempts have also been lately made to cultivate cotton in the province of Cuttack, but I understand that they have not succeeded. More recently the cultivation of the plant has been undertaken in the Island of Saugor, but sufficient time has not elapsed to enable me to ascertain the result. Dr. Wallich is sanguine in his anticipations of success; and, in fact, it is well known that the plant likes an alluvial soil and the neighborhood of the sea." *

"† Brazil eight per cent. worse, Barbadoes ten per cent. Both plants have, under culture, been found to be triennial (i.e. they produce for three years). The shrub will last longer, but is not productive after the third year."

"‡ The nankeens of China are, perhaps, the stoutest cloths manufactured from cotton; and yet we do not know the plant which produces the wool, nor are we agreed whether the color be natural or artificial. The wool of the *gorseypium religiosum* has much the same color, but it is not supposed that the nankeens are made from this cotton.

article used in our manufactures is grown in districts very remote from the sea. Still it is of importance, that the cultivation of the article should be promoted as much as possible in situations which are near the coast, or which have an easy communication with our sea-ports, because any difficulty or delay attending its exportation not only occasions expense, but in many cases renders the cotton liable to deterioration in quality and value."

"The color of the seed is a distinguishing character in cotton; but nature is arbitrary, if not sometimes capricious, in her arrangements, and the black and the green seed are converted into each other by a change of place and circumstances. The Sea Island cotton, which bears so high a price in our markets, is from the black seed, but I am told that, if it be transplanted to the upland or back country, the black seed in the second year becomes green, and the length and quality of the staple undergo a great change. Upon the whole, however, the green-seed cotton appears to be that which enters largely into the great bulk of our manufactures, and to which our attention should be chiefly directed."

It is remarked, in a communication from Bombay, in 1834, that, "the white-seeded perennial cotton, the New Orleans, and the Egyptian, appear to be deserving of particular attention in future experimental cultivation.

"The American kinds which have been grown in India have the creamy color common to Indian cotton, but that is no disadvantage. The growth in the United States is white.

"The Egyptian specimens are full as brown as the merchantable cotton imported from Egypt; but that color is not a disadvantage, as the cotton bleaches well. The seed cultivated in Egypt with so much success of late years, is understood to have been from Pernambuco, in which country the produce is remarkably white."

I shall now illustrate the growth of that great American plant of the Southern States, which has so completely outgrown and overshadowed its Oriental rival as to have made it, by contrast, a comparatively insignificant affair. Little did the loyal fugitives of the Bahamas think, when in 1786 they sent a few friendly packages of their cotton seed, in the way of remembrance, to the Sea Island friends which they had left behind them, of the immense commercial crop which that seed was predestined to produce; and as I like much to connect effects with their causes, whenever I have data for so doing, I have great pleasure in introducing a short series of American authorities, which appear to me to have that purport, to Australian notice, premising that I think it singular, that though America had several indigenous species of the *Gossypium* family of its own, and one of them, the *Gossypium acuminatum*, which had yielded the kidney cotton variety of Brazil, which was, from its first being known in cotton culture, deemed pre-eminent in value, the States should have nursingly trained the three immigrant varieties, of the Sea Island, the upland Georgian, and the Nankin, into the pride-stem of cottonian greatness, to the utter disparagement of their own invaluable species, which appear to me to have well deserved greater experimental attention than was bestowed.

The following letter by Thomas Spalding, an early Georgian cotton cultivator, is interesting from the light which it throws upon the early days of cotton culture in America :—

"It is known to many that cotton was cultivated for domestic purposes, from Virginia to Georgia, long anterior to the revolutionary war. Mr. Jefferson speaks of it in his Notes on Virginia. Bartram speaks of it in his Travels as growing in Georgia, and I have understood that 22 acres were cultivated by a Colonel Dellegal, upon a small island near Savannah, before the revolution; but this was the green seed, or short-staple cotton. Two species of the same family then existed in this country, the real green seed, and a low cotton resembling it in blossom, both being of a pale yellow, approaching to white; one with seed covered with fuzz, the other with fuzz only on the end of the seed. To explore the first introduction of the short-staple cotton into this country would now, in all probability, be impossible; but we may very well suppose it was by one of the southern proprietary governments, and possibly from Turkey, the trade of which country with England was then of much higher consideration than it has subsequently become; nor would it have escaped those proprietors, many of whom were enlightened men, that the climate of Asia Minor, where cotton grew abundantly, was analogous to the climates of the provinces south of Virginia.

"Just about the commencement of the revolutionary war, Sir Richard Arkwright had invented the spinning-jenny, and cotton spinning became a matter of deep interest. In England, cotton rose much in price; its various qualities attracted notice, and the world was searched for finer kinds. The island of Bourbon was alone found to produce them, and yet the Bourbon cotton greatly resembled in its growth our green seed cotton, although it cannot be its parent plant, for all attempts at its naturalization in Georgia (which were many and repeated) have failed. It gave blossoms, but was cut off by the frost in the fruit, nor would it ratoon or grow from the root the next year, in which too it resembles the green seed cotton of our country. This is all I am able to say, and perhaps all that is necessary to be said of the short-staple cotton.

"The Sea Island cotton was introduced directly from the Bahama Islands into Georgia. The revolutionary war that closed in 1783, had been a war, not less of opinion and of feeling, than of interest; and had torn asunder many of the relations of life, whether of blood or of friendship. England offered to the unhappy settlers of this country who had followed her fortunes, home but in two of her provinces: To the provincials of the north she offered Nova Scotia; to the provincials of the south, the Bahama Islands. Many of the former inhabitants of the Carolinas and Georgia passed over from Florida to the Bahamas, with their slaves. But what could they cultivate? The rocky and arid soil of those islands could not grow sugar cane; coffee would grow, but produced no fruit. There was one plant that would grow, and produced abundantly: it was cotton. The seed, as I have been often informed by respectable gentlemen from the Bahamas, was in the first instance procured from a small island in the West Indies, celebrated for its cotton, called Anguilla. It was, therefore, long after its introduction into this country, called Anguilla seed.

"Cotton, as I have already stated, had taken a new value by the introduction of the spinning machines into England. The quality of the Bahama cotton was then considered among the best grown; new life and hope were imparted to a colony and a people with whom even hope itself had been almost extinct. This first success, as is natural to the human mind, under whatever influence it may act, recalled the memory of the friends they had left behind them.

"The winter of 1786 brought several parcels of cotton seed from the Bahamas to Georgia; among them, in distinct remembrance upon my mind, was a parcel to Governor Jatnall, in Georgia, from a near relation of his, then surveyor general of the Bahamas; and another parcel at this same time was transmitted by Colonel Roger Kelsall (who was among the first, if not the very first, successful grower of cotton) to my father James Spalding, then resident on St. Simon's Island, Georgia, who had been connected in business with Colonel Kelsall before the revolution. I have heard that Governor Jatnall, then a young man, gave his seed to Nicholas Turnbull, lately deceased, who cultivated it from that period successfully. I know my father planted his cotton seed in the spring of 1787, upon the banks of a small rice field on St. Simon's Island. The land was rich and warm, the cotton grew large and blossomed, but did not ripen to fruit; it however ratooned, or grew from the roots the following year. The difficulty was now over; the cotton adapted itself to the climate, and every successive year from 1787 saw the long-staple cotton extending itself along the shores of Georgia, and into South Carolina, where an enlightened population, then engaged in the cultivation of indigo, readily adopted it. All the varieties of the long-staple, or at least the germ of those varieties, came from that seed; differences in soil developed them, and differences in local situation are developing them every day. The same cotton seed planted in one field will give quite a black and naked seed; while the same seed; planted in another field, different in soil and situation, will be prone to run into large cotton with long boles or pods, and with seeds tufted at the ends with fuzz. I should have great doubts if there is any real difference in these apparent varieties of the long-staple cotton; but if there is, all who observe must know, that plants, where they have once intermingled their varieties, will require attention for a long series of years to disentangle them.

"Subsequently to 1787, as the cultivation of cotton extended and became profitable, every variety of cotton that could be gleaned from the four quarters of the globe has been tried, but none of them save one has resulted in anything useful. James Hamilton, who formerly resided in Charleston, and who now resides in Philadelphia, was indefatigable in procuring seed, which he transmitted to his friend Mr. Cowper, of St. Simon's Island. Mr. Cowper planted some acres of Bourbon cotton; it grew and blossomed, but did not ripen its fruit, and perished in the winter. Mr. Hamilton sent a cotton from Siam; it grew large, was of a rich purple color both in foliage and blossom, but perished also without ripening its fruit.

"Nankin cotton was produced at an early period, by Secretary Crawford. It was abundant in produce, the seed fuzzy, and the wool of a dirty yellow color, which would not bring even the price of the other short-staple

cottons, but I knew it to produce three cwt. to the acre on Jekyl Island, in Georgia. The kidney seed cotton, which produces its seed clustered together like a kidney, with a long strong staple extending from one side of the seeds, and which I believe to be the Brazilian, or Pernambuco cotton, was tried, and was the only new species upon which there could have been any hesitancy; but this too was given up, because not as valuable, and not as productive. I have given the names of gentlemen, because I had no other means of establishing facts.

"Your very obedient Servant.

"THOMAS SPALDING,

"Darlen, Georgia."

The Hon. W. B. Seahrook, the corresponding secretary of the Agricultural Society of South Carolina, in a valuable report on the causes which contributed to the production of fine Sea Island cotton, published in 1827, says:—"The plantations of the gentlemen whose letters are under review are similarly situated, four of them being indented with creeks, and located on large rivers; and all of them, in point of effect, exposed to the salutary action of the ocean's spray. In proportion to the distance from the seaboard and to the want of a free circulation of air from the south, is in general the downward graduated scale of coarseness in the cotton produced. These causes operate increasingly as you recede from the ocean, until a point is reached at which long cotton cannot be profitably cultivated."

"Salt appears to be one of the principal causes of making the cotton fine in quality and long in the staple. Hence, and from the sandy nature of the soil, the sea coast is so favorable to the growth of cotton; and hence it is established, that salt mud is the best manure for a cotton plantation. The cotton of Mr. Burder and his favored associates, is indebted for its celebrity to the combined requisites of fineness, strength, and evenness of fibre. Upon what principles are these distinguished properties dependent? These planters use, not only extensively, but almost exclusively, salt mud. This manure is known to impart a healthful action to the cotton plant; to mature rapidly its fruit, and to produce staple, at once strong and silky. Mr. William Seahrook, from a steadfast adherence to the application of salt mud, has literally converted a pine barren to as fruitful a soil as Edisto Island can boast. That silicious and argillaceous soils, in the order narrated, are the best adapted for cotton, every cultivator of this article is well aware. From experiments by Captain Bailey, a member of this society, it has been clearly demonstrated that salt added to a compost, in the ratio of one hushel of salt to every sixty hushels of compost, has been attended with the most decisive advantages in relation to the quantum and quality of cotton. For every description of soil in which sand predominates, he felt warranted in averring that salt clay mud was the manure which would effect the double purpose of a profitable harvest, with its desirable correlative—a fine quality. Salt clay mud acts rather negatively than positively. It does not add very materially to the product of cotton; but from its conservative and maturative power the fruit, which the combined operation of soil and season may have disclosed, it is nearly certain of

retaining and ripening. In a propitious season stimulating manures will yield a larger crop than salt mud; but, for a series of years, the latter will more certainly repay the industry and skill of the planter. For the cultivation of the best cotton there are two other requisites besides a sandy soil, proximity to the sea, and salt clay mud as a manure:—First, very great care is necessary in the selection of the seed; and second, there must be diligence in weeding, pruning, and in every part of the cultivation. The seed should be selected from the most perfect, early stalks, produced on the best land; and it is indispensable frequently to change the soil and situation, in order to keep up the quality of the produce yielded by any particular kind of seed."

"Whitney's cotton gin" (says an authority quoted in papers relating to an American tariff), "has hardly been of less importance than Arkwright's machinery." And "American cotton is not only freed from any admixture of seeds, but it is also divested in the most complete manner of the pods and other extraneous matters, as well as of discolored and damaged heads. Indian cotton, on the contrary, is generally mixed with both."

"Cotton (writes Stuart, who travelled in America in 1830) is most extensively raised in the southern States, and has, *even in some of the countries of Virginia*, supplanted the culture of tobacco." "The black seed and green seed cotton are the two kinds generally cultivated. The black seed is of superior quality, and thrives best near the sea coast; that of the finest quality on the Sea Islands of Georgia and South Carolina. The green seed is more prolific, is not so liable to be damaged by the inclemency of the season, and is better adapted to inferior or exhausted land. Cotton is cultivated as an annual plant, growing sometimes as high as six feet, and throwing out a number of branches, on which form large and beautiful whitish-yellow blossoms. It is kept perfectly free of weeds, and is thinned carefully with ploughs in the form of scrapers. The process of picking commences in September, and is renewed again and again as it ripens, at successive periods. A laborer will cultivate, with ease, more than twice as much cotton as he can collect. The ordinary quantity picked in a day is between 50 and 60 lbs. Children from eight years old can be employed to advantage to pick the cotton. On the cups of the flower balls or co-coombs, or, as they are here called forms, grow three or four elliptical seeds, three or four times as large as a wheat kernel, and of an oily consistency. The cotton is the down with which these oily seeds are generally enveloped. The gathering season often continues for three months, or more, until it is necessary to burn the old stalks, in order to commence ploughing for a new crop. The quantity of oil that cotton seed yields has been estimated at about one gallon to one hundred pounds of seed. The cotton in the seed undergoes an operation called ginning, performed by a machine discovered by an American, which detaches the down from the seeds and blows it away, while the seeds fall down by their own weight. It is then packed in bales, which being pressed are ready for exportation. The quantity of cotton produced on an acre varies from 1400 to 800, or 600 pounds, 700 pounds being

a fair average crop. The price of cotton is extremely variable, the green seed fluctuating from sixteen pence sterling to five pence, and the black seed from one shilling to one dollar per pound. Much of the soil of South Carolina consists of swampy land, which is devoted to cotton and rice."

The following remarks on the culture of cotton in the United States of America were published in 1829: "The preparation of cotton-land requires most particular attention. It must be repeatedly ploughed and frequently harrowed, say twice or thrice, until it is thoroughly pulverized: drills four feet apart, in some instances three, are then made with a plough, into which, if the soil be poor, old well-rotted stable manure is placed, and at the distance of one and a half to two feet, a hole, not exceeding one inch to one and a-half inch in depth, is made with a hoe, and a handful of seed dropped therein, which must be immediately covered with the soil. The planting generally takes place between the 20th April and 10th May; the earlier the better, in order that the cotton may be matured before the appearance of the fall-frosts. The richer the soil, the larger and better the crop, as with every vegetable. When the plants are about one inch above ground, they are thinned with the hand, leaving four only. At a later period, and when all danger from worms, &c., is well over, they are again thinned, and two only are left to bear; from these, by hoeing or ploughing, the weeds must be kept clear, until the bolls are perfectly ripe and begin to open, which occurs during September and October. As they expand freely, the cotton must by hand be picked clean from the boll, and being a little damp, exposed for a day or two, in a dry situation, to the rays of the sun.

"The quality of cotton first picked is always the cleanest and best. To save trouble, it is customary with some planters to defer picking out any of the crop till the whole of the bolls be ripe, and have expanded and become dry by the influence of frost or cold weather. This plan is to be deprecated, for the bolls open most irregularly: those first expanded are left to be injured by rains, dews, and decayed leaves, &c. When the crop is picked from the boll, it is spread over the floor of a room (should the cotton be damp) till it is dry, and is then sent to the gin, when the seed is extracted from the fibre. During the first week in August some planters, when the crop is not too extensive, top each plant to the first eye, leaving six branches only to bear. This increases the quantity and quality, but forces the plant to throw out suckers, which are most difficult to keep under.

"Stiff clayey soils require more seed than light sandy ones. The plant being very delicate, requires the united efforts of several shoots to force its way through the surface, which often becomes packed and hard. Where seed is abundant, a large handful should always be sown in each hole; where it is scarce and the land light, a small quantity may suffice. Two hundred English acres would require from eight hundred to one thousand bushels of seed-cotton.

"An acre will produce from one thousand six hundred to two thousand pounds of seed-cotton, or four hundred to five hundred pounds of clean or ginned cotton; but this is a large yield. Generally, on average soils, from

one thousand two hundred to one thousand six hundred pounds of seed-cotton, or cotton in the seed, are produced to the acre. Our bales weigh from three hundred and fifty to four hundred pounds."

The following statement, on the best method of cultivating New Orleans cotton, was published in 1836: "The cultivation of cotton is simple and easily understood, so that a few general directions will suffice to describe our manner of preparing a cotton-field, and the care and attention requisite to keep it free from weeds and grass.

"As to the most suitable soil for growing fine cotton, I would prefer that which is rich, light, and dry; but it is generally thought, that *new land* does not produce as fine a quality of cotton, as that which has borne one or two crops of grain previously. The situation should be such that there is no danger of an overflow of water, which would seriously injure the plant. In preparing the ground we use the plough entirely, and lay off the rows from four to six feet; and where the soil is as rich as the alluvium of the low grounds on the Mississippi, even eight feet is not too much. We open the ridges by running a narrow drill, by plough or otherwise, and sow the seed in it as we would grain, covering it lightly with a harrow.

"The plant on its first appearance, and for some weeks, is extremely delicate and easily injured by careless working. The rows, at first thickly covered with plants, must in about ten days be thinned out, so as to leave the stalks single, at the distance of eleven inches or a foot from each other: or as some of the plants may be lost or destroyed, we generally leave two or three together; but in about two weeks more, at furthest, they must be reduced to one, as experience has proved that the plants will not flourish if at all crowded. While thinning the rows, great care must be taken to clear them of all grass and weeds: in the early age of the cotton this is done with the hoe. In a short time after, to facilitate the work, we use ploughs between the rows, where every thing must be kept down, and not a blade of grass should be suffered to grow. The only art in making a good crop of cotton is in the rule, not to suffer any thing to grow among the plants until it is fully matured.

"The time of planting, or rather sowing our cotton, varies according to the season. Generally we begin from the 1st of April to the 15th; as a rule, I would say as soon as there is no further danger of frost. These general observations, I trust, will be sufficient; indeed it is impossible to fail in making a cotton crop, provided the ground be kept perfectly clean and the plants be not crowded. The quality of the cotton depends more, perhaps, upon care and attention in gathering and drying it, than upon the culture of the crop.

"From the 1st of September, or sooner, the bolls begin to mature and open successively, until winter has stopped the vegetation of the plant. As soon as the boll has completely opened, the cotton, which then hangs partly out of its shell, and has become almost dry, must be gathered by hand. Care must be taken by the picker to take hold, with his fingers, of all the different locks of the cotton, so that the whole comes out at once, and without breaking off any of the dry leaves about the boll. If any fall upon

the cotton before the gatherer (or picker, as we call the laborer) has secured his handful in the bag which hangs out at his side, it must be carefully taken off. It is necessary to use a close hag to gather the cotton : for the plant, though still flourishing, has on it many dead and dry leaves, which are easily shaken down ; and it is this leaf which the spinners object to so much, and which will always lower the price and quality of cotton. After gathering the cotton, it should, as soon as possible, be exposed to the sun on scaffolds, and thoroughly dried ; and if not immediately ginned and packed, must be stored in secure barns.

"I deem it useless to enter into a description of our gins and presses. I will only observe that a cylinder of sixty rags ought not to make more than six hundred to eight hundred pounds of clean cotton in twelve hours : if made to run faster, the cotton would not be so clean, and the fibres might often be broken or cut by the too rapid motion of the rags."

I shall close my cottonian extracts with the following short series, which have reference to other districts than India and the American States. It pleases me much to think, that the seed sown by the African Society has been long productive of good fruit ; and as I think cotton culture will furnish to the free African abundance of that light kind of labor, in which his poor bonded brother has shown himself an adept, I shall heartily avail myself of the opportunity which resumption of cotton culture, in my field of mental labor will yield me, of supplementing the directions of the African Society by a contribution of my own, especially intended for African regions, in the way of return for any benefit which may accrue to Australian beginners from the African directions, until an Australian Cotton Grower's Manual shall appear in print.

"Previous to the year 1800," says Roger Hunt, in his *Observations upon Brazil's Cotton Wool*, published in 1808, "Pernambuco cotton was estimated by the British manufacturer, chiefly for the fineness and silkiness of its staple ; but at that time a large proportion of it was much reduced in value, by the quantity of stained cotton, as well as leaf, seed, and other kinds of dirt, which it contained.

"About the period above mentioned, inspectors appear to have been appointed in that part of the Brazils, for the purpose of remedying the complaints upon these points, and from that time all the cotton from Pernambuco has been greatly improved in cleanness and evenness of color ; but by some mismanagement, the greater part of it has been gradually losing that soft, fine, silky texture, which formerly constituted its principal value, and a large portion of the import for some time past has been comparatively coarse in the staple and less bright in color.

"It may therefore be worth while, at our entrance upon the new relations which are likely to subsist between Great Britain and the Portuguese government established at the Brazils to enquire into the causes of this alteration in the quality of Pernambuco cotton, with a view to the recovery of its former valuable properties, and combining them with the improvement which has taken place in cleanness and evenness of color.

"The writer of these observations being unacquainted with the interior management of the cotton plantations in Pernambuco, is unable to say how far that part of the change alluded to, which relates to the fineness of the staple, may in any degree be owing to that invariable tendency which all vegetables have to degenerate, by inattention to the essential points of frequently varying and interchanging the seed and the soil: he will therefore deem it sufficient merely to have hinted at the necessity of these requisites being duly attended to, and confine himself to such causes of the change which has taken place in the general properties of this cotton as are more obvious, pointing out what appears to him to be the proper remedies, as he proceeds.

"The first and most material defect is, the state to which the cotton is reduced by the new mode of cleaning. Formerly (before this mode was adopted), it appeared to have undergone no operation but that of hand-picking, and was therefore, with the exception of being freed from the seed and some part of its other imperfections, sent to market in nearly the state it was gathered from the plant, which is the most favorable state cotton can be in for all manufacturing purposes, as the fibres will then separate with the application of a very small force, and thereby the process of carding (the first which it undergoes, and on the perfection of which all the rest depend) is rendered not only more easy, but much more perfect; whereas, by the new mode of cleaning, whatever it be, the fibres of the cotton are so entangled and matted together, as to produce a degree of stiffness and adhesion particularly unfavorable to the operation in question. It requires double the force in carding to separate the fibres, the effect of which is, to break the staple, and thereby to increase the proportion of waste usually made by the flyings from the cards; and after every degree of skill and attention on the part of the manufacturer, it is at last impossible to separate them so perfectly as to produce in the spinning a fine clear even thread. A farther objection to cotton-wool in this state is, the additional stress which it lays upon the machinery, the effects of which are to reduce the quantity of work capable of being produced by a given power, and to increase the wear and tear, which in both cases adds to the expense of the article produced.

"Upon the subject of color, the want of that silky brightness which formerly characterized Pernambuco cotton, appears to arise from a part of the stained cotton being in the new mode of management so mixed up and incorporated with the good, as to prevent the possibility of its being afterwards detached, and thence a dinginess of color is communicated to the whole, besides the essential properties of the staple being injured in whatever proportion the stained cotton bears to the perfect. Thus it is that all the Pernambuco cotton, to which these objections apply, is reduced, in point of value to the manufacturer, to nearly the scale of the inferior sorts, such as Surinam, Demerara, &c, namely, two-pence, three-pence, and four-pence per pound. It being, for the reasons before mentioned, inapplicable to the finer branches of manufacture or to any purpose for which the above sorts are not nearly as well calculated.

"To obviate these defects, it is recommended that, in gathering the crop, particular care be taken to keep the stained and dirty cotton separate

from the more perfect ; which may be done, for the most part, by each laborer having two bags (or such other vessel as there may be in use), one for the stained and inferior, the other for the good cotton, in order by preventing their being mixed in the first instance, to avoid the necessity of any of those operations in cleaning, which produce that adhesion of the fibres, and that defect in the color so generally complained of. It is then recommended, that the prime part of the crop should, as far as the state of labor will admit, and after the seed has been carefully separated, be finally cleaned and prepared for the bag by hand-picking only, without the use of sticks to beat or shake out the dirt (called by the West India planters switching), or any other machinery whatever, it being in this stage that the mischief complained of (no doubt) takes place.

"A due attention to these particulars, would materially increase the value of the principal part of the crop, and would probably bring some of the finest marks into competition with Sea Island Georgia, which would produce a further advantage upon such marks of one penny to three-pence per pound; and it is suggested that the stained and inferior cotton, after having undergone as much cleansing as circumstances will admit, would always find a market in England, at a price which would probably more than reimburse the planter for the extra labor bestowed upon the first quality. It is scarcely necessary to remark, that the practicability of what is here recommended must depend greatly upon especial care being taken, that in separating the seeds from the cotton they be not broken, and thereby mixed with the wool, which, whenever it happens, must necessarily render the process of hand-picking tedious and expensive.

"After what has been said relative to Pernambuco, it cannot be needful to advert so particularly to the other sorts of Brazil cotton: it will be sufficient to point out their faults, and refer to the management recommended above for the remedy.

"Maranhão has, of late years, been for the most part coarse in the staple and dirty, and the dirt so incorporated with the wool as to be difficult and expensive to separate.

"Bahia cotton has retained its properties better than the two former sorts; but its faults always were, and still are, a great deficiency in color, owing to the stained cotton not being taken out, and many bags having much whole seeds, leaf, and other kinds of dirt in them, which admit of an easy remedy by the mode suggested, of gathering the stained cotton separately from the good, in the first instance; and as the pernicious method of cleaning adopted in Pernambuco does not appear to be in use at Bahia, this cotton would then come to market in the state approved by the British manufacturer.

"The writer being anxious to be fully understood, will here repeat that the great principle of what he wishes to recommend is, that after the cotton is gathered from the plant and the seed carefully separated, the prime part of the crop should undergo as little other change from the state it is in when gathered, as is consistent with its being bagged perfectly clean, as every process beyond that of hand-picking has an unavoidable tendency so to connect the fibres as to make them difficult of separation, and also to

deprive the cotton of that bright silky appearance, which formerly was the distinguishing character of the Brazil cotton-wool. He will also repeat the recommendation, that the stained and inferior part of the crop be rendered as clean as the state of labor will admit, and sent to market under a separate mark or title; and will conclude by requesting the planter always to bear in mind, that the difference in price, in the British market, between coarse and fine, clean and dirty cotton, falls wholly upon himself, the duty, freight, and all other charges (commission excepted), being upon the weight or package, and not *ad valorem*.

"The above remarks upon Pernambuco cotton apply with still greater force to nearly the whole of the import from Surinam, the mode of cleaning which (judging from the state of the cotton) must be still more objectionable than that used in Brazil, most of the Surinam of late years, possessing not only a more tenacious adherence of the fibres, but the staple being actually *broken*, apparently by some kind of machinery introduced to supersede the necessity of hand-picking (probably the gin used in America). This will account to the Surinam planter for that gradual approximation in price between Surinam and New Orleans cotton, which has been taking place for some years past, not from any improvement in the latter, but by the former being reduced in value, by the mode of cleaning, at least two-pence to three-pence per pound. It may be observed that *color* is not a subject of complaint in Surinam cotton, which for the most part is more perfect in that respect than any other sort.

"Nearly the whole of the Demerara and Berbice planters appear, of late years, wisely to have abandoned the injurious practice of *switching* their cotton, and it now only remains for them, by the method herewith recommended, to divest it of the stain and dirt, which is more or less a subject of just complaint against the greater part of what *now* comes from these colonies. Such marks as have come clean and even colored since the practice complained of has been discontinued, have generally sold higher than the best Surinam, and in some instances at the price of Pernambuco."

"Since the observations which I printed in 1808," adds Mr. Hunt in some further observations printed by him in 1828, "Brazil cottons have undergone some improvement. In consequence of the very extensive and growing application of the American Upland Georgia and New Orleans cotton to the purposes of the British manufacturers, added to the introduction of cotton from Egypt, since the year 1823 (which competes with the Brazil and other *black-seed* descriptions), there has been such an abundant supply of long-stapled cotton in proportion to the consumption, as to have reduced the prices of that class, at the present moment, to within twenty per cent. of the American green-seed cottons, taking the average price of each class; whereas, previous to the import of Egyptian cotton, Brazils and other black seed cotton generally ranged fifty per cent. above the American. If any further attempt should be made to improve the cultivation of cotton in India, the question occurs, how far it might be advisable to try the black seed, as an experiment, in the first instance, for the purpose of ascertaining the difference in the expense, compared with the quantity produced of each class.

"With regard to the leading descriptions of cotton at present produced in India (*viz.*, Bengal and Surat, including in the latter the whole of the imports from Bombay), the Bengal may fairly be considered to be out of use with the British manufacturer. Surat cotton, such as a good portion of the imports of 1817 to 1826 consisted of (that is, good, clean, bright-colored, thomil cotton), would always find a consumption to a certain extent; which, of course, would be increased if the staple could be a little improved by the introduction of seed from America, particularly from New Orleans. The best quality of the Bombay cottons have always been considered to be the Broach and the Surat, which in good seasons are equal in staples to middling bowed Georgia. But the cargoes from Bombay, which have been arriving for the last twelve to eighteen months, have, from their almost entire want of every property estimated by the British manufacturer, been the cause of many of those who were previously in the habit of using Surat cotton turning their backs upon it; and it can only be by a very great improvement, particularly in cleanness, that they can be expected to return to it. It appears to me, that the cause of the depreciation is principally owing to the very slovenly way in which the crop is gathered from the plant; and without a thorough reform in that particular, it will be of little use introducing new seed, or increasing the expense of cultivation in other respects. If the crop be carefully gathered when in a proper state of maturity, agreeably to the instructions in my observations for the benefit of the Brazil planters, it will require comparatively little other cleaning, beyond freeing it from the seed by the American gin, in its most improved state."

The following directions for the culture of cotton in Africa, were printed by the African Society, after Mr. Hunt's publication of 1808; "Cotton grows in any soil that is not over moist. The common opinion, however, that it flourishes most in barren or impoverished land is erroneous. It will doubtless grow in thin arid soils not exhausted by previous cultivation, yet there cannot be a doubt that it will prove more productive in good or middling land, consisting of a loose dry mould free from clay or marl. If the inclination of the land be sufficient to carry off the water, the labor of trenching and draining which is necessary in level lands will be saved. As no plant requires so little rain as cotton, the close vicinity of high mountains is injurious to it, while it is beneficial to the coffee. On the other hand, the saline air of the sea-shore, which generally destroys coffee, is favorable to cotton.

"The land for cotton must be cleared in the dry season, and the operation should commence in sufficient time to allow the wood and brush which have been cut down to dry, so as to be burned before the rains set in. The process of cleaning need not be described. It would, however, be a great improvement of the method which prevails in Africa, if the underwood and small wood were grubbed out, and the large wood were not only cut down, but its branches lopped off, and its trunk also cut into such logs as may be easily removed and heaped together for burning. The more completely the ground is cleared, the more productive is the cotton likely

to be. It certainly, however, would not answer to grub out the larger stumps and roots; they must be left to rot, which they would do in a few years.

"In situations where the rains are not violent, the cotton seed is generally put into the ground at the early part of the rainy season. But in places differently circumstanced, this operation is deferred till the rains are within a month or two of their termination, with a view both to guard against an over-luxuriant vegetation, whereby the plants might exhaust their strength in branches and leaves, and to avoid the injurious consequences of rain at the time the blossoms are appearing and the pods forming. In Africa, the best time for planting the seed must be regulated by experience, and by the result of experiments to be made at all seasons, from March to September; but the earlier the seed can *safely* be sown the better.

"In Georgia and Carolina, considerable labor is bestowed in ploughing and harrowing the ground, and forming ridges raised pretty high with trenches between. This, no doubt, assists vegetation, and at the same time serves to carry off the water from the flat lands. The same thing is done, though less carefully, with hoes in Demerara and Berbice, but it is seldom done in the West India Islands. There, however, the fields are regularly laid out and the holes opened in straight lines. The distance between the holes varies from five feet in poor soils, to eight feet in rich soils. The holes are made by loosening the earth for about eight or ten inches or a foot square, and five or six inches deep.

"From six to fifteen seeds, spread longitudinally, may be put into each hole, and covered over lightly with earth, not above one or two inches deep at most. The more moist the ground is the more lightly should the seed be covered, otherwise it will be apt to rot. The plants will generally show themselves in from five to nine days, but sometimes not before fourteen. When they have four distinct leaves, half the number in each hole may be drawn, and these must afterwards be gradually reduced until one, and that the most vigorous and healthy plant, is left in each hole.

"For the first six weeks the plants are of slow growth and very tender, and they must be carefully kept clear of weeds until they become of a sufficient size to suppress all extraneous growth. It would be of great service, also, that the earth should be occasionally drawn up about the roots until the blossoms appear, when this operation is no longer necessary. At the end of six weeks, if not before, the plants if luxuriant ought to be topped or pruned, by breaking or cutting off an inch or more from the end of each shoot, which makes the stems spread and throw out a greater number of branches; and this operation, if the plants are very luxuriant, will require to be performed a second or even a third time, with a knife, on the stem and branches.

"The blossoms generally appear in about eighty days after the seed has been planted, and sometimes later, and the first pods arrive at maturity in about three months from that time. The blossom of the green seed when it first appears, which is generally in the morning, is white, and remains of that color for the first twelve hours; but it changes the following night to a beautiful crimson, and drops off within thirty-six hours of its first

appearance. That of the black seed, or Sea Island, undergoes the same change with the green, but when it comes out it is of a deep yellow color.

"The cotton should be fully blown before it is picked. This may be ascertained by its separating *easily* from the pod or husk. When it adheres to the pod and must be forced from it, the cotton will be of an inferior quality. Great care should be taken to gather it as free from trash or dirt of any kind as possible, which will save much trouble afterwards in the cleaning. Cotton ought not to be picked after rain or while wet, as in that case it will be stained and of little value.

"In gathering the crop, particular care should be taken to keep the stained and dirty cotton separate from the more perfect, which may be done by each laborer having two bags, one for the stained or inferior, the other for the good cotton. The value of the latter would be greatly increased, and even the inferior would always find a market in England.

"The next operation is that of separating the cotton-wool from the seed. Of all the modes of effecting this, *hand-picking* is doubtless the best, because the most favorable state in which cotton can be for all manufacturing purposes, is, with the exception of being freed from the seed, that in which it is gathered from the plant. Whatever serves to entangle or mat the fibres is injurious, because when matted, they require in carding a greater force to separate them; and the effect of this is to break the staple, and otherwise to produce waste and inconvenience to the manufacturer; besides which, a fine, clear, even thread, can hardly ever be produced from matted cotton.

"The process of separating the seed from the cotton-wool by the hand is in general attended with so much expense as to be impracticable; though in Africa, perhaps, from the cheapness of labor, the difficulty may be less. Machines have therefore been substituted for this purpose, called gins, of which the common foot-gin is probably at present the best for Africa.

"There is another kind, calculated to work by cattle, wind, or water, which may hereafter be produced with advantage, but would be found too expensive and complicated at first.

"The black seed being loosely attached to the wool, is easily separated by the gin without injury to the staple.

"The green seed, on the contrary, adheres so closely to the wool that it can only be separated by a saw-gin, which cuts the staple and depreciates the cotton one half, but if *hand-picked* it would be more valuable.

"The green seed is more productive than the black, but the wool of the latter is of considerably higher value.

"It is hardly necessary to observe that that mode of ginning is to be preferred, which tends least to break the seeds and entangle the fibres of the cotton.

"After the cotton has been ginned, it should be carefully examined and freed from all motes, broken seeds, stained wool, &c., as its value in Europe much depends upon the condition in which it is packed. The usual mode of packing is this. A bag is suspended through a round hole in the floor of the cotton house, its mouth having been previously distended by a hoop. Into this bag the cotton is thrown by small quantities, and pressed down by

a stout man standing in the bag with a pretty heavy pestle of hard wood. From two hundred weight and a half to two hundred weight and three-quarters, should be compressed into five yards of bagging.

"In America, four acres of cotton and four acres of provision are generally the proportion planted for each laborer, and which therefore each laborer is capable of managing. To pick fifty pounds of cotton in a day is considered as a fair task for one person.

"The plants should be cut down every year, within three or four inches of the ground. The time for doing this, which must be in the rainy season, ought to be regulated by the same circumstances which regulate the planting of the seed at first, and that the subsequent management, in this case, will also be the same as has already been pointed out in the case of the plants from the seed.

"It would be a great advantage, if every third, fourth, or fifth year at farthest, the plants were to be grubbed out, and their place supplied by means of fresh seed brought from a distance. This would prevent the cotton from degenerating, which it never fails to do when it has been propagated in the same ground for many years without a change of seed; and would, of course, preserve its quality and maintain its reputation in the European market. Great care should be taken to prevent a mixture of the different kinds of seed in planting: each kind should be kept perfectly distinct.

"The process called *switching*, or beating the dirt out of cotton by means of sticks, ought if possible never to be resorted to. The necessity of having recourse to this expedient, which can only arise from previous negligence, ought to be obviated by the means already pointed out; it deteriorates the quality, and consequently lowers the price of the cotton.

"In the gathering and hand-picking, and even ginning of cotton, great use may be made both of young children and infirm people, who are incapable of exertion of any other kind."

The following pertinent remarks on cotton appeared recently in the *London Times*, and were subsequently inserted in the *Melbourne Argus*:—
 "It is not that cotton will grow only on particular soils, like cinnamon or pepper, the article can undoubtedly be produced in fifty different regions of the globe, nor is there much reason to doubt that any quality desirable could be imparted to the crop, by cultivation and skill. This is not the secret of the matter. The real difficulty is that America has got fair possession of the market, and supplies us with cotton so excellent in quality, and so nearly sufficient in quantity that only narrow margin is left for fresh competitors. Coming to figures, we may state that the weekly consumption of the kingdom, in 1860, was probably about 48,000 bales; of these nearly 41,000 came from the United States, about 2000 from Brazil, 1800 from Egypt and the West Indies, and 3200 from India. There is the whole case clearly explained. America sends us six-sevenths of our entire supply, and maintains that vast supply so well and so successfully that the market is all her own." "All that we can gather from the American example is encouraging. That wonderful trade, which now yields the United States a

revenue of fully £40,000,000 a year, is as purely artificial as a trade can be. The plant was imported, and the labor was imported. Everything was accomplished by industry and enterprise; and what has been done once can be done again. Take a soil and climate favorable to the growth of cotton, and the cotton trade can be created to a certainty. It was not even a work of time; seven years sufficed to raise the produce of cotton in America from 500 lbs. to 18,000,000 lbs., from a single bale to 36,000 bales. It must be remembered, however, that this feat was only accomplished by untiring energy and abundant capital. The enterprise was amply remunerative, but no negligence was admitted in the work. The southern States fairly gave themselves up to cotton planting, and made cotton their sole staple, at the cost of all earlier products."

There does not, however, appear to me to be the slightest necessity for such an ultra course in Australian husbandry. All that I shall advise is to make cotton the chief Australian vegetable textile product, so long as its culture will pay equally well with any other product in the like demand, and similarly circumstanced in its requirements as to capital and labor, but not to an extent which might impede the due development of the other sciences intended to be engrafted on the aspiring branch of our noble Anglo-Austral tree.

In bidding adieu for the present to the important subject of cotton, I may state that the foregoing remarks and their illustrative extracts are culled from a manuscript work on the subject, on which I have for some years employed my leisure hours, from a conviction that the importance of cotton culture would in my time induce Australian attention to it, and that a concise treatise on the subject was needed, that of Royle, which extends to 607 octavo pages, being too verbose for the majority of readers, and the history of Baines, which extends to 544 pages, being fuller on manufacturing details than of those on culture; and I may add that what I now print, save to the extent of half a dozen pages, has found its way to the press thus early solely in consequence of my wish to aid promptly in the endeavor to improve the American crisis to Australian advantage, and to call attention to the promising indication that Victoria possesses cotton growing capabilities in great plenitude.

The scope and importance of the special culture branch of Australian husbandry being now apparent, I shall close this department of my subject with the observation that though I have allotted in my agrarian domain, as adjusted for South Victorian management, so much, as a moiety of the whole, for the area of my lower branch, and have circumscribed the range of my middle branch within a lesser area, and of my aspiring branch within one still less; I have, nevertheless, in cropping import, approached so near to a true tertial arrangement as that, when Australian experience shall have taught me what will most profitably fruit, my aspiring branch in a North Victorian domain I can, by assigning one of the cow pastures to the duties of the water meadow and adding the site of that meadow to the special

culture department, and curtailing in length the eight arable fields, and expanding correspondingly in width the four special culture allotments, readily, by mere reduction in the scale of dairying, which is essentially a South Victorian product, so enlarge special culture management as to obtain an absolute equilibrium in the tertial management of all my three branches, in the positions in which that equilibrium shall appear advantageous. When, however, it is considered that the eight arable fields are charged with the duty of providing the soiling and store food, and the grazing crops of cereals and clovers, for the middle branch, and of providing also land space for such of the textile and dye, and medical and commercial products of the special branch, as are adapted for annual rotatory culture, and are, moreover, jointly with the middle department, charged with the duty of providing manure for all the land in special crop, the approach to true tertial proportion is much nearer, even in a south agrarian domain, than may at first sight appear.

Having thus sketched in outline the three branches of our noble Anglo-Austral plant, I shall now discuss some important matters which my subject suggests.

Irrigation is predestined to be a prominent feature in Australian husbandry, and though it may seem paradoxical it is nevertheless my impression that irrigation will be more general, and will be earlier and better developed in Australia than it would have been had its rivers been without drawback and fluvial at all seasons of the year. The spur of necessity is an excellent goad for onward move; and I was much struck in a survey of the badly-watered districts of England, which I made before I left it, at the superiority of the contrivances for raising water to the surface, and for conserving it when there, to those of better watered districts. The pumps and cattle ponds evidenced that the men who constructed them understood their business, and they were generally very judiciously placed. The necessity for water conservation will lead to expert practice, as well as economy, in Australian water management; and I shall predict that miles of river-bed, when skilfully deepened where excavation happens to be soft, and consequently comparatively cheap, will be found to make excellent reservoirs; that the application of clay to porous places, to prevent percolation, and the construction of dams, to preserve elevation in rivers at present of little use, will lead to the irrigation of thousands of acres, which without water would have remained desert; that the hitherto incalculable waste of water, by exhalation from an unnecessarily expanded surface, will be

reduced amazingly by the confinement of that water within contracted, but deeper, surface bounds; and that the augmented capacity derivable by many existing lagoons, from judicious embankment, will justify the cost. A shallow lagoon is a nuisance, but deepened into an English mere it may become a blessing, and a source of wealth to its locality. Lagoons indicate the natural levels of a district, and many of them will doubtless be found worthy of conversion into public reservoirs. They ought all of them to be carefully examined in seasons of drought, with a view to prospective deepenings of the deep places, and by removal of the excavated stuff to the nearest shallows, make decided land of them, and thus lessen the surface exposed to evaporation. I have an impression that when the ratio at which evaporation progresses shall have been correctly ascertained, the extravagance of the Australian evaporative oblation to the clouds will be thought astounding.

Telford, the great self-taught engineer, in a communication to the Shropshire Agricultural Report, published in the year 1803, in which he expounded his views in regard to the improvement of the navigation of the river Severn, (an object then mooted), writes thus: "The second plan is to collect the flood-waters into reservoirs, the principal ones to be formed among the hills in Montgomeryshire, and the inferior ones in such convenient places as might be found in the dingles, &c., along the banks of the river. By this means the impetuosity of the floods might be greatly lessened, and a sufficient quantity of water preserved to regulate the navigation of the river in dry seasons, and to answer many other useful purposes, such as the forming of ponds for inland fisheries, the supplying artificial canals, and the watering of land. This, it is thought, might even prove the simplest and least expensive mode of regulating navigable rivers, especially such as are immediately on the borders of hilly countries." The idea was worthy of Telford. The Yan Yean reservoir of this colony may be considered as an illustration of Telford's thought.

I observed, with pleasure, a statement in the Report on the resources of Victoria, before adverted to, that in the Hamilton district "good water could be obtained wherever tried for, at an average depth of seventy feet." That circumstance indicates that there is, at all events there, a vast subterraneous collection of water, raisable to the surface by comparatively simple machinery,

and it strengthened a conclusion, to which I had arrived in England, that, though the exhalation of a warm climate having great surface exposure would account for the disappearance upwards of much water, it was, nevertheless, probable that more than was suspected, found its way, by percolation, to subterranean receptacles.

It happens luckily for the Victorian agriculturist, that water is essential for gold washing, and that its storage for that purpose has become an object of colonial concern. That circumstance has operated beneficially in procuring him a golden ally in his fellow colonist, the miner, who has had his application for aid responded to; and I think it probable that the gold fields water vote may initiate the adoption of Telford's fine conception as to a general system of water storage along the mountain range, which so conveniently bisects the colony. The diffusion of water, like the diffusion of knowledge, becomes enhanced in proportion to the elevation of its source; a lofty conception being worth a thousand grovelling ideas, and a gallon of water at the mean altitude of the range being of greater value for many purposes, than ten thousand gallons of the same water would be at the mean level of the surface of the colony. The books of the Sydenham Crystal Palace concern would, if referred to, as to their fountain-towers, and machinery cost prove this. The word "prospecting" having come into general Victorian usage, I would suggest prospecting water search reconnoitres along the ranges before private ownership shall have been allowed to create any impediments to the formation of mountain meres, exactly where they ought to be, in order to take a northern or a southern watershed, as the general weal of the colony may prescribe. It will be found easier and cheaper to reserve than to re-purchase, and I may state that my present object is rather to provide prospective facilities than to precipitate expenditure, knowing the delicacy and difficulty of dealing with vested rights, whether acquired by grant or by user. A granted eighty-acre section may be detrimentally in the way of irrigation over eighty thousand acres, and it is my wish to avert the intrusion of such "dog in the manger" policy into one of the finest fields for engineering enterprise which the colony has to offer, and which may affect, for weal or for waste, (by getting permanently into the wrong watershed, or making an improper detour), an incalculable quantity of the water of the ranges, which has called forth this suggestion.

I am anxious that every facility shall be given for the extraction of as much of the gold of the colony, as is findable, whilst its standard price is influenced by the erroneous notion that it is a scarce metal; but I am impelled, by conviction, to state my belief, that the permanent wealth of the colony will be found in its agricultural resources, rather than in its mineral treasures. There will always be uncertainty and reckless gambling in gold mine management, the blanks being many, and the prizes few, though valuable when won, *if* kept from squander: but the agricultural produce of the colony will, if augmented by general irrigation, be both permanent and great, and the advantages are in prospect, such as will justify the agricultural interest, in claiming "prospecting" encouragement and water grant funds from the colonial revenue, to an equal extent with the mining interest. The agricultural returns, given in the Report on the resources of the colony, fully sustain my own estimate, that the produce of the land brought under efficient irrigation, may be trebled. The agricultural statistics of Italy give a greater increase, especially in the district of Lombardy, where the supply of water, on given terms, has long been a matter of public economy; and as I see, by the Victorian Land Act, that rivers and water frontages are to be matters of government reservation, it will follow, that a trust for the due distribution of the water among the land owners entitled will attach upon the reservation. That trust will, probably, be delegated to Commissioners, or peradventure, to District Boards, or be placed under municipality jurisdiction: be that as it may, it will become one of the most certain sources of colonial revenue, if it is managed with skill and economy. In mining districts, the joint funds of the agricultural and the mining interests, will justify expenditure, which neither interest could risk separately, and it is in such districts that we are to expect the triumphs of engineering skill, in gaining or keeping surface elevation for motive power, or for feeding land which, by position, could not have been otherwise reached. If much of the mountain ranges shall be auriferous, or shall command auriferous land, or land yielding other valuable mineral products, the importance of every yard of permanent elevation in a mountain reservoir will be great; and as the temperature of the air will, at an elevation, be cool, that circumstance will lessen waste by evaporation. Much will be effected towards a complete system of irrigation by attention to the following points,

viz., the establishment of a general system of lockage on such reaches of river bed as carry an approximate level long enough to justify the cost; claying over porous places, where the water is found to disappear, and piping water through sand-bed reaches to the next lower reaches which have retentive bottoms; the conversion of lagoons into meres of half their surface area, and ten times their storage capacity; providing artificial reservoirs in proper places, where none previously existed, and tracking surface indications of underground water runs, to the highest level at which, on the artesian principle, they can be brought to the surface as springs; establishing connection, where thought desirable, between one body of water and another, so as to extend the benefits of irrigation as far as practicable; the drainage, into deep ravines, of shallow waters and morasses, so as to make the water available, and relieve the atmosphere from the noxious exhalations and insects which such localities engender; the ascertainment, in every locality, of the depth at which water is generally found under ground, and, as far as practicable, of the quantity of the supply, and to what extent it is effected by seasons of drought; and the ascertainment, also, of where the bulk of the water, which takes a downward course, first disappears, with a view to its prevention.

The irrigation of grass land, as practised in England, is of English origin and was not an Italian introduction. Nothing can be more inductively beautiful than the following incident recorded in the *Treatise of Old Vaughan*, the Father of English Meadow Floating published in the year 1610: "In the month of March I found a molehill raised on the brim of a brook in my meadow (in the county of Hereford), and from it there issued a little stream of water drawn by the working of the mole down a shelving bank, one pace broad and twenty long. The running of this little stream did wonderfully content me, seeing that it was pleasing green, and that other land on both sides was full of moss and hide-bound for want of water. This was the first cause of my undertaking the floating of ground, &c., &c., &c." Here we have the record of when and how one of the greatest of English agricultural improvements was suggested, and a text worthy of voluminous paraphrase in any system of Australian husbandry. I have often wished that the poet Cowper had been aware of this incident when he so beautifully apostrophized the mole in his

Task, because he would have contemplated with delight this little mole instructing Vaughan, and through him mankind, not only in the construction of a true artesian well, but also in the best application of the water which its engineering skill and labor had brought to the surface.

It has been ascertained that Victoria receives on an average as much rain water as England, and I cannot but think that if water conservation is economically and skilfully carried on, water meadows will be formed in many favorable positions at a reasonable cost, and that irrigation to some extent may be practised on every domain.

The *chemistry* of Nature is economy itself; no particle of any substance is lost in her operations. She literally extracts bread from stones, by making fertilizers of mineral earths, and deriving aliment for animal and vegetable life, as well from organic substances as from those which are inorganic. Nitrogen, carbon, oxygen, hydrogen, lime, magnesia, potash, soda, sulphuric acid, phosphoric acid, chlorine, and other fertilizing substances, at her bidding, pass out of any one of her three kingdoms into any other, and after having accomplished her purpose can be made to reassume the position in which she found them; measure for measure, weight for weight. What a fine field, therefore, is opened by the agricultural chemistry of the latter half of the nineteenth century to the industry and skill of the Victorian cultivator, who has within his reach nearly every substance, mineral, vegetable, and animal, which have been found to yield manure; and some of them cheaper and in greater abundance than the British farmer is able to procure them. The decomposed lava of some volcanic districts which, from its color, has been named chocolate soil, is a good fertilizer and will improve the staple of the poor lands of the localities in which it is found, if it is applied after the manner of marl, when the progress of settlement shall have given to poor land sufficient value to induce the operation. Beds of marl will probably be found, as in England, buried beneath many of the sandy districts, which only want their application on the surface to become useful land, and transmute them from the dreary sterility of desert wastes into districts as fertile as similar application has made that of English Norfolk.

The sources of *manures* appear to me so manifold, and some of them to trend so much in the direction of the marvellous and the vast, that I scarcely know what substance in the three kingdoms of nature to instance, from which fertilizing matter cannot be extracted; and, when I found in the English application of manures, so unpromising a material as grauite, yielding when calcined a fertilizer of considerable value, a sort of mental ejaculation to the purport of that of friend Dominie Samson—prodigious I escaped me. Even sea sand, which in days of yore was metaphorically referred to as the emblem of the countless and the vast, must be content now-a-days to be reckoned in its aggregate as a simple unit in an agriculturalist's list of fertilizers, which are in reality inexhaustible; because, every grain of sand becomes a particle of fertility when mixed with clay, or some other such substance. Chemical science by revealing to the agriculturalist the constituents of manures of known efficacy, and by the discovery of new ones, has effected in my time a complete revolution, as well in theory as in practice, in their application: perhaps, I cannot better illustrate the obligation of agriculturalists to science, than by the following statement. In 1846, Professor Henslow, the botanist, laid a paper before the British Association, at Cambridge, on the abundant occurrence of the bones of whales, on the crag beds of the coast of Suffolk, along with large quantities of rolled pebbles, which were at first supposed to be coprolites, but which were in reality particles of phosphate of lime. These pebbles, though placed in a district where they were predestined to revolutionize the capabilities of the soil and though perceptible to view, had been unaccountably hidden from use, and might have long continued in that ignorantly hidden state, but for Henslow; who, in pursuing his inductive investigation and demonstrating the value of the deposit as a substitute for guano, performed a service to his country and to the agriculturists of other countries also, and probably to those of Australia, as well; for, as the southern hemisphere abounds in whales, it is more than probable that some of those which lived in ancient days have left their bones in similar deposit, as a fertilizing legacy to Australian husbandry, available when that husbandry shall have advanced in intelligence far enough to make discovery of the mortuary deposit, and claim the legacy.

The importance of manures and their mode of operation have, however only of late had due investigation; and though the day has not yet arrived in which an intelligent agriculturist can restore with precision to land coming forward in crop rotation the exact equivalent for the productive power expended in producing previous cropping, that day is probably not very distant; and I look forward to the feeding of plants by manure, skillfully cooked and applied, becoming as systematical and as well understood as has already become the feeding of animals with plants.

For my purpose a six-fold classification of manures will suffice, and I shall content myself with instancing just as many in each class as will illustrate the great bounty of nature, and warrant my conclusion that with thoughtful husbandry there will be no lack of fertilizing resources in Victoria; because it luckily happens that the bulk of them are procurable on reasonable terms; and it will, I apprehend, meet the requirement of

this essay, if I merely instance in regard to application the feeding of the crops enumerated in my own example course.

1. Animal substances yield :—Human excrement and urine ; animal excrement and urine ; poultry, and pigeon, and other land bird excrement ; guano, which may be taken as the type of all sea fowl excrement ; putrid fish ; blubber, and oily substances ; bones ; horns ; hair ; feathers ; blood ; refuse fat and carrion ; woolen rags ; corals ; sponges (which yield gelatine) ; lime ; coprolites ; and pebble phosphates, &c. , &c., &c.

2. Vegetable substances yield :—The straw and chaff of grain ; the haulm of pulse ; malt dust ; rape cake and refuse ; cotton cake and refuse ; linseed cake and refuse ; hempseed cake and refuse ; charcoal ; woody fibre and ashes ; tanner's spent bark ; refuse hay ; green crops to plough under ; sea weeds and samphire, and their ashes ; peat, and its products ; vegetable ashes and alkalies ; and the refuse of vegetable oils, &c. , &c., &c.

3. Mineral substances yield :—Marl ; chalk ; gypsum ; salt ; alum ; clay for burning, and also for mixing with other substances ; sand and the debris of quarries ; burnt granite ; copperas ; and bituminous matter, &c., &c., &c.

4. Mixed and Miscellaneous substances yield :—Soot ; soap's waste ; gas works refuse ; and a host, defying comprehension and compute, of artificial manures, which have given rise to a new commercial staple of great importance.

5. Composts of earthy matter ; produced by intermixture with almost every one of the foregoing substances.

6. Liquid Mannres : which, aided by irrigation, will in troth, become enriching streams of fertility. I may, in conclusion, state that the Flemings estimate the tanked urine of a cow at £2 per year.

The word conservation points explicitly to vast sources of manure as well in Victoria as elsewhere. Every bone, and every particle of animal and vegetable refuse, for which there is as yet no demand, ought to be collected and buried in proper localities until it is wanted. The same remark will apply to the sewage of our incipient municipalities, and though I do not wish to see the nasty practice of the nasty Chinese as to human excrement obtain in Australia, it ought not to be allowed to pollute rivers and watercourses, and be lost to agriculture by excessive dilution, when it can be easily conveyed by underground vaulting to some fitting and deeply sunk receptacle, there to abide until agricultural demand shall give it value. Urine is employed as manure, either in the liquid state or with the fæces which are impregnated with it. It is the urine contained in them which gives to the solid fæces the property of emitting ammonia, a property which they themselves possess only in a very slight

degree. "When it is considered," says Liebig, "that with every pint of urine a pound of wheat might be produced, the indifference with which the liquid excrement has been regarded is quite incomprehensible." The great chemist might have expressed himself still more strongly, had he chosen to do so, on the great waste in former times of all manures. The following quotation from Arthur Young's *Agricultural Tour through the North of England*, published in 1770, shows the comparatively recent period at which town manures became an object of sufficient value in general estimation to be worthy of conservation. In speaking of a locality in East Yorkshire, he says: "They are, throughout this track, attentive to the manuring of their land. Lime, after being long unknown, is coming into use, and those who have tried it find great advantage from the practice. Soap ashes they buy wherever they can, and find nothing to exceed them. All sorts of manure is bought at high prices at Hull, and carried nine or ten miles around. Rape dust from the oil mills is a capital article with them, having found it of prodigious benefit to all sorts of land; but it is chiefly laid on their barley land. All other sorts of manure, such as coal ashes, horse, hog, and cow dung, the sillage of streets, &c., &c., &c., is purchased at 3s. a wagon-load of fifty bushels, and spread on the fields to great profit. About fifty years ago, the manuring from Hull was begun by a poor man who hired a close of grass; he had four asses which he employed constantly in carrying away ashes and dung, and spreading them upon his pasture, the improvement of which was so manifest that his neighbors followed the example; whoever brought away manure, for many years, were paid for taking it. Twenty-five years ago it was to be had for less than a shilling a load, but the country around, by degrees, all coming into the practice, the price has arisen to its present height; extraordinary good stuff will sell for five shillings a load." How instructive and important was the lesson which the sagacious and industrious man alluded to by Young taught!

That manure, which is now allowed to be to land what daily food is to the animal, should have been so long in arriving at appreciation, and should have had such a discoverer, is a singular incident; and that it should be a century after that before liquid manure and its easier and cheaper distribution became appreciated, is as singular. The reliance of my course of cropping will be chiefly

on the homestead supply, and that supply will have its source in the soiling system, and in tank conservation. The judicious use of both solid and liquid manures is the point to be aimed at. It is not my intention to go through the various manures seriatim, as I should if I was writing a treatise, but merely to communicate some particulars within the range of my own observation and experience, as to particular manures in certain cases.

The classification of manures into those which amend the staple of the soil, and those which stimulate or improve vegetation is good, though some manures (as for instance lime) act as amenders of the soil, and as stimulators and feeders of vegetation also. The following remarks on the conservation and management of homestead manure, both in a solid and a fluid state, appear to me to fall within the proper scope of this essay, and I shall, therefore, adduce them; premising that some of them are only partially original, and that I shall adhere to the aphoristical form in which they stand in my note book.

In mixing the straw used as litter with cattle dung to increase its quantity, and afterwards by watering the mass to induce fermentation, the manual performance of Experience is in fact a scientific operation, and her inductive lesson accords with what Science thus taught: "Manure must be soluble before it can be effective; and this solubility can only be produced by the putrefactive process, which a moistened dunghill promotes." The exact stage of decomposition in which it is most advantageous to apply homestead dung has not, as yet, been conclusively determined by either experience or science, though much has been said and written by the disciples of both. Experience inclines to the opinion that it ought to be applied when the straw is uniformly of a mahogany color, and so rotten that it readily breaks into short pieces, without having entirely lost its form; and Science will probably endorse that opinion, though she has not, as yet, done so.

As manure is wanted at different seasons of the year, it is advisable to have it collected near the place of application; and so managed, as that so much as is wanted for a particular purpose shall be in a uniform stage of decomposition, as near the state thought most advantageous for the purpose in view, as is practicable; and, if the manure collected is not in that state when wanted, then the putrefaction of the oldest portion must be retarded, and that of the newest accelerated, until both old and new are brought to the same state; otherwise there may be mischievous contrariety of operation: when, however, the manure has been brought to a uniform state, as to decomposition, and has been ploughed in with a shallow furrow, it soon incorporates with the soil and affords a succession of soluble humus, or mucilage, which gives regular nourishment to the crop. It is sometimes advisable, for special or experimental purposes, to keep the dung produced from different animals, separate; as, for instance, the dung of cows distinct from that of horses, or of cattle feeding on oil cake or grain and turnips

from those fed on straw or refuse hay only. Cow dung has been found most effective on light soils; and horse dung on those which are cold and heavy. The richer the food with which an animal is fed, the richer will be its dung, and the further it will go; because, a less quantity will suffice to produce a required result. A general mixture of the dung of all the animals of an establishment, mixed with all the straw used in their littering, will produce manure of an average quality, adapted for any land and for any purpose, though, for light soils, it should be more decomposed than it need be for those which are heavy. *Manure being to land what daily food is to an animal*, ought to be supplied in quantity, and with a regularity proportioned to the exhaustion of the cropping taken; but experience reports that with land, as with animals, it is better to feed lightly and often, than to gorge with a large quantity at once; save in the cases of such crops as potatoes, mangel-wurzel, and Swede turnips, which require a rich earth, and have been found to possess an amazing capacity for digesting manure.

It is acknowledged that urine and similar animal substances have a more powerful effect on the soil when they have undergone a certain degree of putrefaction than when they are used in a fresh state, and it is allowed that this putrefactive process is produced with the least loss of substance when the liquid has been confined in close vaulted cisterns which admit the external air only partially. On light soils this liquid has a most fertilizing effect, if it is used in small portions at a time. On very heavy soils this effect is not so apparent, and for such soils the liquid is mixed with sand or with any light earth before it is applied, or instead of using it at once upon the land it is poured over the litter which has been collected in a heap or in a yard after having served for the cattle. In the common mode of collecting farm yard dung, straw gets very unequally impregnated with animal matter; at one time it will contain a large portion and run rapidly into fermentation, at another there will be so little that it is with difficulty heat is excited in it. By separating the urine and the litter, straw will go much further, and can be mixed with the urine at the most advantageous time, and it thus forms a much richer manure in a smaller compass, from not being so much diluted with water. Should there be a deficiency of straw, earth or sand may supply its place, so far as regards the soaking up of the rich juices. The use of straw in dung may be considered as making it a sponge to hold the liquid animal matter in its pores or tubes. The great use of liquid manure on light soils is to impregnate them with soluble matter which, being diffused through their substance, supplies nourishment to the roots of plants wherever they may shoot out. It may be applied to the land at any time before the seed is sown, and also soon after the blade springs up or the seed begins to form; in short whenever the plant requires fresh nourishment, or when that which existed in the soil is diminished. Without liquid manure the poor sands of Flanders could not be cultivated, much less produce crops which vie in quantity and quality with those on the best soils. The quantity of dung, in a very rotten state, which this soil would require, according to the common system of manuring could not be produced by all the straw which could be raised upon it under ordinary cultivation; but cattle produce urine, and urine produces

in return roots for cattle. The great effect of liquid manure has set agriculturists upon finding some artificial substitute for the urine and the watered dung of cattle; such substitutes are obtained by mixing all kinds of animal refuse with water and inducing putrefaction. The emptyings of privies is scarcely a substitute, for it is the same as the liquid from the stables in a more concentrated form, but the refuse of oil mills and various manufactures when diluted and mixed with a portion of putrid urine soon become assimilated to it. This has become a branch of trade in those countries where nothing will grow without manure, and is a resource where an increasing population demands the cultivation of inferior soils to supply the necessary increase of food, as well as an increase of produce from those which are naturally fertile. Notwithstanding the value and importance of liquid manure, it is not to be supposed that solid dung may be altogether superseded by liquid manure, which, however active and immediately effective, soon loses its power, whereas solid manure well prepared and ploughed into the ground will last for several crops. It is the judicious use of both manures conjointly which has the best and most permanent effect. Solid manure after being ploughed in requires time before it can have any direct effect on the germination of the seed, or on the nourishment of the plant; liquid manure, on the contrary, acts from the moment it is poured on the surface; it is the milk of the young plant, which sends out its fibres to receive it after it has undergone that slow transmutation which forms humus, and has become in a proper state to supply the more vigorous roots with sufficient nourishment. Various means have been adopted to increase the quantity and efficacy of manure. The simplest is to increase the number of cattle kept and husband their manure to the best advantage. It is evident that letting cattle roam at large in pastures is a great manure loss, not only on account of much of the dung which is dropped, but also of much of the urine which though the essence of manure gets thereby wastefully applied. On the contrary, wherever soiling and stall feeding are practised land gets highly manured, and the crops become more certain and abundant; for with stall feeding, as with the soiling system, is connected a much more economical management of homestead manure which is effected by keeping the litter and the more solid parts of the dung separate from the urine, and the liquid parts until collected in large reservoirs to be used either in the liquid state or applied immediately to the land, or in the formation of compost heaps with earth and vegetable substances purposely collected to be mixed with the straw which has served for litter.

Sir John Sinclair, on the authority of several eminent farmers, states in his Code of Agriculture that one ton of straw, if properly manufactured, will produce four tons of manure, and until Australian agriculturists shall have formed a reliable estimate of their own that statement may serve as a criterion by which to estimate any given year's manure from the quantity of straw used as litter. The exertions of an industrious cultivator to increase the quantity and improve the quality of every species of manure, both solid and liquid, will be repaid by the increased cropping which will be consequent, but careful experiment is alone to be depended upon in the adoption of new manures and of new modes of application.

Lime is both stimulative and enriching, and I am glad to find it abundant in the colony. I propose to use it on the clover leys for wheat, so that its application will recur on the same land every fourth year. That use will be consonant with good English practice on soils of strong staple, abounding in humus. It is useful both in its caustic state of quick lime, and in its milder form of carbonate, or chalk. Lime is less porous than sand, and more so than clay, and has therefore an improving effect on soils in which either sand or clay prevails. It acts also chemically as an alkaline earth, and greatly assists the good effect of the enriching manures of animal or vegetable origin. Newly-burnt lime has a peculiar effect upon all organic matter, which it burns or dissolves by taking from it a portion of the water and of the carbonic acid which it contains. On humus, which is the result of animal and vegetable decay in the earth, it has a peculiar effect, rendering it soluble in water, and, as a consequence, fit to enter the minute fibres of the roots of plants. This circumstance is probably the secret of the effect of lime on certain soils, and its comparative inaction on others. In some places where the soil is peculiarly poor—as, for instance, a pure silicious sand, washed by the sea or by rivers—lime is found to do no good, there being no ingredient on which it can operate; but on rich alluvial clays, which contain much organic matter, it is the best of manures, both in a caustic and a mild state. Caustic lime readily unites with the half-decomposed fibres of vegetable matter, such as straw, heath, and the like; and it accelerates their decomposition, inasmuch as by its means the dead fibres of the roots of vegetables which remain in the earth when the plant is removed, become soluble, and their elements entering into new combinations, supply the materials for the various vegetable substances which are then to be produced. As long as there is a store of organic matter or humus in the soil, lime will be found an excellent manure; but as soon as this is exhausted, lime only adds to the sterility by destroying the fibres which the seed throws out from its own substance by the assistance of light and moisture.

Lime therefore, when properly applied, is beneficial; but it becomes inert and even noxious when it is applied injudiciously. The property to which it owes its chief power in promoting vegetation, is its combining with certain elements of decayed animal and vegetable matter, and forming a compound which is soluble

in water, and attracts carbonic acid and moisture from the atmosphere. This substance is readily taken up into the sap by the fibres of the roots, and supplies the plant with oxygen, hydrogen, and carbon, which are the elements of all vegetable substances, except a few, which also contain nitrogen. Air, water, and carbonic acid are sufficient to afford all the elements of vegetables; and the use of lime is chiefly to facilitate the absorption of these elements, in addition to depositing a very minute portion of the pure earth in certain parts of the vegetable. In addition to its effect on the humus of the soil, lime acts also on the clay which it may contain; and where this is abundant, its effect is very beneficial. The use of quick lime in rendering inert vegetable fibres soluble, and hastening the decomposition of animal substances, is of the greatest importance in agriculture. Substances may be rendered highly enriching in a short time, which without it would have been long dormant in the soil, or on the dunghheap. When there is peaty matter in the soil, which by reason of its tannin principle, is of itself incapable of putrefaction, lime is the true remedy; for, assisted by feculent matter to produce a degree of heat and fermentation in it, lime soon dissolves peat and converts it into real humus, than which there is no better food for vegetation. Lime has a leavening effect on strong soils, and renders them much more porous and receptive of the influences of the atmosphere than they were before its application. It also corrects acidity, and assists the nutritious effects of animal and vegetable manures. When spread over a soil abounding in vegetable matter, it makes it active by dissolving the half-decomposed fibres and converting them into a soluble mucilage; and because of its property of attracting moisture rapidly, a small quantity produces an immediate effect; and when spread over clover leys, preparing for wheat (which is its best application), it soon reduces the clover stems and roots to humus; but the spreading is not to precede much the sowing of the seed, because it would, in that case, lose its chief power by attracting carbonic acid, and become carbonate, or chalk, and the expense of burning would be then in great measure thrown away. I have dwelt somewhat lengthily on lime because of the important part which it will have to take in Victorian husbandry, especially when railways shall have made it reachable in every agricultural district of the colony; and the regular growth of clover and of some other

crops occasionally ploughed under, shall have periodically provided material which chemistry is to transmute into humus.

Chalk is composed of 44 parts of carbonic acid and 56 of lime. It is used to improve various soils. The best land for the growth of wheat contains a certain portion of argillaceous, siliceous, and calcareous earth, and when the last-mentioned is deficient, the addition of chalk improves the soil more than any quantity of animal or vegetable manure could do alone. The soils most improved by chalk are the strong wet clays which contain a portion of iron. Chalk acts as an absorbent, corrects astringency, and prevents, by its interposition between the particles of clay, that running into a solid mass which is so detrimental to the roots of plants, by entirely excluding atmospheric air. On loose sands its effects are different; there it acts chiefly as a cement, and the more argillaceous it is the better it binds the siliceous particles. An important use of chalk is to form ponds in porous soils for the use of cattle. A stratum of chalk, a few inches thick, protected by a coat of gravel and sand, to prevent its being trod through, will effectually retain water; and if a considerable proportion of salt is beat up with it, and intimately mixed, it will effectually prevent worms from making lodgments in it, and keep in water for a very long time. It is of advantage to throw chalk into all ponds used by cattle; as it corrects any acidity which may arise from stagnation, and the water in which chalk is diffused is more wholesome than that which contains clay alone.

Gypsum is found in several Victorian localities, though not as yet in large quantities. Its abundance in the neighborhood of Paris has occasioned its being called plaster of Paris. It is composed of sulphuric acid and lime; a ton to the acre, or a pint to four feet, is a fair application. The action of gypsum in producing luxurious vegetation is owing to its power of absorbing the ammonia of the atmosphere which by its solution in water and absorption in that state by the spongelets of the roots is thus yielded to the plants. The ammonia existing in rainwater is (whenever it comes in contact with gypsum) at once absorbed by it, and is no longer volatile, but becomes fixed. The decomposition of gypsum by this process of absorption of ammonia goes on very slowly, and this explains why the action of gypsum lasts

for many years. Gypsum has a septic quality which promotes putrefaction in animal and vegetable substances, and is therefore a useful ingredient in composts of which the principal part is farm-yard dung. The plants on which gypsum produces the greatest effects are clover, peas, beans, vetches, sainfoin, lucern, colza, rape, and plants with broad leaves. It has but little effect on the cereals. It is to be regarded as a stimulant, and not as a substitute for dung. The softer the water of the locality in which gypsum is to be used as manure the greater will be the effect. I propose applying it in my course with beans, peas, lentils, vetches, gramme, buckwheat, sorghum, hemp, clover, and rape.

As to *composts*, an economical practice which I first noticed in Cheshire, and subsequently introduced into other localities to advantage, is worthy of Australian notice. The fold-yard is excavated in the form of a washing-basin, and is in the beginning of winter bedded with a layer of loose soil a yard in thickness; by imbibing and retaining the ooze from the mixen above, this soil comes out in the spring first-rate stuff for top-dressing grass land, which is the purpose to which it is generally applied.

The fundamental principle upon which composts are made is that of impregnating portions of earth with those parts of the dung of cattle which, in common dunghill management, would have been dissipated and lost. Composts have the effect of accelerating or retarding the decomposition of animal and vegetable substances by the addition of earths, such as chalk, marl, clay, and even sand, according to the nature of the soil on which the compost is to be used.

In the formation of composts the principal objects are, to regulate the decomposition of the organic substances, and to increase the bulk of the manure, by means of less expensive materials than straw. For these purposes lime or chalk is generally preferred; the former, in its caustic state, to accelerate decomposition of fibrous matter, the latter to add to the mass and absorb any portion of acid, which is produced in a certain stage of the fermentation. The most useful material is peat or turf, which may be laid in layers with quick lime and earth, the whole being well soaked with liquid manure. If any kind of vegetable matter, such as fern, broom, the tops of heath, or pond weeds, can be added, it will be so much the richer. The lime and urine acting on the peaty matter, its tannin is decomposed and transformed into humus, the woody fibre is dissolved, and the whole mass, when turned over and well mixed, becomes a very rich earth; which, being spread on the land and slightly ploughed or harrowed in, greatly enriches its surface. By this means many poor soils may be improved when the cultivation is not sufficiently extended to produce straw.

Charcoal may be very beneficially applied to land whether in grass or tillage, especially where irrigation is not practicable. It has great powers of absorption both of moisture and the gases, and renders them to the land by gradual process. Pure and fresh-burnt charcoal has the power of absorbing 90 times its volume of ammoniacal gas, and 35 times its value of carbonic-acid gas; but the power is much diminished if the charcoal is reduced to a state of powder. When used for agricultural purposes it should be broken just small enough to allow of its being equally distributed over the surface of the soil. In this state it will absorb any gas with which it may come in contact, and if any manure has been applied containing ammonia in its free state, liable to pass off in a gaseous form, the charcoal will absorb it as it rises, and return it again to the plant with the first rain which falls. When, in the course of cultivation, the charcoal is ploughed under, it does not even then lose its powers of absorption, but continues its operations below the surface with considerable effect. Bakers' ember-refuse is worth collecting, and ought not to be wasted. Wood being abundant in the colony, charcoal may be had at a reasonable cost, and that circumstance will prove a great boon to the agriculturist. I propose to use it chiefly on the pastures and the permanent herbage of clover and lucern, and (if needs be, and the supply is equal to an allowance for the annual clovers) to extend it to them also. I am glad to find wood abundant in the colony, because, until irrigation comes into general operation, charcoal will be the great regulator of surface moisture by gradually yielding to the land and its herbage the moisture which it has absorbed. In pastoral districts, where irrigation is impracticable, charcoal will be found invaluable, and it is in dry climates like that of Australia that its beneficial effects will be manifest. This is one of the manures in which the Australian agriculturist has a great advantage, for the price of charcoal would be ruinously high in some countries.

Bone Manuring is one of the most important of modern agricultural improvements, and I have witnessed such surprising results from the application of ground bones in Cheshire and the adjoining counties of Salop and Stafford, that I shall enter my protest against the waste of a single bone. It is upon old grass land, on soils of a clayey texture, that boning has produced the amazing results

detailed in English agricultural publications. I was, myself, entrusted with a large boning outlay in a dairying township, the results of which greatly exceeded the expectations both of the tenants and myself, and was much quicker in its return than we any of us expected. The land had been previously underdrained with a view to the operation, which, no doubt, greatly facilitated the transition from very bad cow pasturage to very good. The two operations, in fact, doubled the rental value of the land boned. I had concluded my arrangements with the tenants at a midsummer rent-day, and fixed upon the fields to be first boned, leaving the purchase of the bones and their spreading on the land to the management of the principal tenant. He was very prompt, and was so fortunate as to get all the bones he wanted at one establishment, and, as the tenants co-operated well in their carriage of the bones, all the land was boned that autumn, which happened to be very suitable. The land having been all of it formerly under the plough, was in butts, and I directed a butt to be left here and there unboned, so that the effect of the boning might be apparent. At the Christmas rent-day, the boning affair was the chief topic of conversation, for all the tenants were pleased with the indications of improvement which had begun to be manifest, but as snow was on the ground, I had to be content with their report. The winter and the following spring were, both of them, very favorable; and when I visited the estate at the following midsummer rent-day, my path lay across an elevated field which, at the distance of a mile, overlooked the boned estate. The view delighted me, for my eye rested at once on every boned field. The yellow brown of the butts left unboned contrasted so disparagingly with the deep green of those which had been boned, as to be a conspicuous object of notice at the distance of a mile. On my arrival at the estate, I went immediately to a field, and cut two sods, one from an unboned butt, and one from an adjoining butt which had been boned. On dissecting the sods, I discovered that the change in the color of the herbage was to be attributed to the impetus given by the bones to the white clover pre-existing in the land, for round every splinter of bone a clover stem had entwined itself, and then, cherished by a new aliment, and strengthened by the support which connection with the bone afforded, it sent forth roots downwards into the decaying vegetable mass of coarser herbage, which had too long been paramount, and

had kept it under, and then threw out tendrils right and left, which, by contact with other splinters of bone, repeated the process until luxuriant clover had become the predominant herbage of land in which it had never been noticed before. The cows, unaccustomed to such dainty food, ate so greedily of it that they bared the ground, and that circumstance aided the effect of the boning, because the finer plants, which had also pre-existed in the land, encouraged by the improved texture which drainage had given to the soil, and enjoying for the first time free atmospherical exposure by the disappearance of the mosses and rough plants, in which they had been long stifled, and fed by the bone aliment and by that into which the corpus of their oppressing neighbors had been transmuted by the change, grew so vigorously that the change was really marvellous. On dissecting the unboned sod, I found that it contained all the plants which had had development by the boning, but so weak and silvery in stem, and scant in foliage, as to require care in their identity. The rental value of the land was doubled by the operation, and the change was permanent; for on visiting the district twenty years after the boning, I found clover still the predominant herbage, and was amused with the epithet "boned land," by which the land in question was then designated, by reason of its acquired value.

The bones had been boiled and subjected to a novel chemical process, to exact some ingredient wanted for some manufacturing purpose, which I understood was a failure. The circumstance had, however, created a local prejudice against the bones, which operated to our advantage, for we had them a bargain by taking the lot, though the success of our experiment, and the non-success of the speculation which had led to the boiling of the bones, prevented our getting our after supplies on easy terms as to price. We tried, on a small scale, crushed bones which had not been boiled at all, some also which had been half boiled, and some which had been fully boiled under the ordinary process, for all of which we paid comparatively high prices; but the cheap bones answered the best. The operation of the unboiled bones was slow, and it was a dozen years before remunerative effect was produced; but they in the sequel paid, and when I saw the land twenty years afterwards, the herbage was evidently much improving, and though white clover was not so predominant, some valuable plants of the locality, which I much liked, were gaining the perfect

development, which had given great value to the herbage of the land of the locality, which happened to be naturally good. The half boiled bones were comparatively high in price, and did not, either at the first or in the sequel, return benefit proportionate to their extra cost; nor did the boiled bones do so well as those which had been boiled for the specific object to which I have adverted, by which I inferred that some chemical agency, to which they had been subjected, had helped our purpose. Bones act stimulantly and powerfully on arable land, and I have seen great crops follow their application, especially on light soils in wet seasons; but the benefit is transient, and not of a permanent nature. I have an impression that the most economical Australian application of bones will be in renovating the natural pasturage of the colony, and developing indigenous herbage plants of value, which, from some obstructive cause, need nurture; and that is why I have given so much space in this essay to my English experience. Verily, every bone ought to be saved, and there ought to be at least one bone-mill in every agricultural municipality.

Though Australian *guano* is considered an inferior article in the English market, and is said not to pay for carriage there, it is sufficiently important to be conserved for Australian use. It is, as is well known, the excrement of sea fowl. The more ammonia it contains the greater is its value, and sixteen per cent. of that ingredient is expected in Peruvian guano. Some chemists, however, take the per centage of nitrogen as their criterion of value, and on that test report that a ton of Peruvian guano is equal to thirty-three and a half tons of mixed animal and vegetable farm-yard dung. The portability of guano is greatly in its favor, and it has been stated that it unites the advantages of active and of permanent manures in equal degree; half its fertilizing properties being soluble in water, and quickeners of vegetation, whilst the other half continue long in the soil and nourish vegetables by slow decomposition. I, however, question the permanency of guano effect, and am supported in my opinion by an incident which I will narrate. An English Squire, with whose estates I had an agency connection, being minded to create competition among his tenants in the production of Swede turnips, authorised a considerable outlay in guano, for the purpose. I procured first-class Peruvian guano, and the Squire, having a mind to try a little

experiment of his own upon a plot of grass land, caused thrice the quantity which I prescribed as sufficient to be spread on the plot. The weather was showery and favorable, and the grass and herbage which had had guano sprung up to a great height in an incredibly short space of time, and took such a beautiful dark green hue as to be quite a contrast with the surrounding herbage, but the following year it relapsed to its former state. Two years afterwards, on passing the plot, I had the curiosity to examine the herbage minutely, but no improvement whatever, either in the soil of the plot or in its herbage, had resulted. All the tenants had splendid Swedes, and the succeeding barley crops were in every case good, but we all of us concluded, that with the barley crop all advantage from the guano had ceased, and that the soil was not in any case improved in staple by the application. This was a fair experiment, for, though the soils were various, the result was uniform, and we all of us agreed that though the Swedes and the barley had well repaid the guano outlay, the matter there ended. It is probable that guano will be a valuable resource in the winter cropping of cabbages, turnips, kohl rabi, and such crops, as a stimulant, and that it will pay well for the application. It is best applied in moist weather, and should be mixed with thrice its weight of charcoal, peat ashes, or fine soil, for roots and green crops, or of salt when applied to the cereals. It has been applied with profit to turnips, mangel-wurzel, potatoes, kohl rabi, cabbages, carrots, parsnips, beans, peas, vetches and other pulse; to the cereals, and to maize; but I do not propose to extend its use in my course beyond the winter cropping of the two fields before-mentioned, having greater confidence in home-made manure. Guano is to be kept from actual contact with the seed of the crop for which it is applied, otherwise it may destroy it.

Salt is beneficial in husbandry, and is essential to animal and vegetable life; though, perhaps, its effects have, in some cases, been over estimated, and some statements concerning its results require confirmation. Even in Roman husbandry Pliny records that cattle had a liking for salt pastures, and that cows grazed in them gave more milk, and that too of better cheese making quality, than cows fed on insaline lands; which I think likely, because, as is well known to graziers, animals eat heartily when they are in them; and cowkeepers have long been aware that well fed cows yield much more milk, and that too of better quality, than cows which are badly fed. The feeding qualities of well drained salt marsh pastures are so well understood and appreciated that they always command a high rental value; and

I can instance a case within my own experience in which I turned a hunter, who had seen much service and was very poor in condition, into a salt marsh pasture, in Holderness, on the 1st of May, which became so fat and sleek by the 2nd of August following, that I had some difficulty, when I went into the marsh for the purpose of bringing him home, in satisfying myself of his identity. He was restive in temper and a shy feeder, and had, therefore, never before carried much flesh, but the Holderness pasture, in three months, made him too fat for work, so that he had to be gradually reduced in condition for the hunting season, when he came out a new horse, and outdid his former fame. I attach importance to this instance, because I am satisfied that the pasture had more to do than the animal in the change. Holderness is not a cheese making district, and as I have never fallen in with any salt marsh cheese making farm, I am unable to corroborate old Pliny's statement; but it is no uncommon thing in Cheshire, which is the great salt producing county of England, to top dress pasture land with compost in which refuse salt is a considerable ingredient; and dairy cows milk better upon such land after the application than they did before, and eat greedily of that pasturage which they had rejected in a rough state. Holderness had, however, some first class salt marsh butter dairies, but it was thought advisable, in the best managed dairies, to alternate in pasturage between the best marsh grass and seeds and other herbage, to keep cows from getting too fat, and running prematurely to beef. In English husbandry damaged hay and clover is frequently salted to make it acceptable to cattle, who eat not only the salted hay and clover, but also straw mixed with it, more eagerly than they do better hay not salted, and thrive better upon it. Sir John Sinclair states, in his Code of Agriculture, that when he visited the occupant of a large farm in the Netherlands, he was surprised to find a quantity of rock salt from Cheshire, and three reasons were assigned for its use:—1st, that by allowing sheep to lick it the rot was prevented; 2nd, that his cattle, to whom lumps of it were given to lick, were thereby protected from infectious disorders, and cows were rendered more healthy, and, by being induced to take a greater quantity of liquid, gave more milk; and 3rd, that a small quantity, pounded, was found beneficial to horses when new oats were given to them, if the oats were at all moist. In America salt is given to milch cows, oxen, horses, and sheep, and its importance in husbandry economy is there much higher estimated than it is in British husbandry; and I have to call attention to the belief that salt is highly beneficial in cotton culture, and that some authorities hold that the great superiority of Sea Island cotton is the result of saline influence. In Spain salt is given to sheep, to the extent of 128lbs. a year to every thousand sheep, in accordance with the regulations of the incorporation in charge of the immense travelling Merino flocks of that kingdom; and I may state that salt is formed in Spain by evaporating sea water, a process to which its climate is as favorable as is that of Portugal and Sardinia, where a like process is pursued. Australia therefore, which possesses the like climate evaporative facility for the manufacture of sea salt, need never be without it.

When irrigation machinery shall be matured it will probably be found that salt ponds may be artificially formed to supply the pasturage of the

domain with its modicum of salt in a liquid state; and though the operations of art are of necessity on a small scale, a great result may, nevertheless, be induced by the attempt to follow up such a course systematically. Salt certainly gives sapidity and relish to grasses, hay, and other kinds of raw food, but unless it is supplied in small quantities it may be injurious. I do not propose to apply salt either to the cereals or in my arable course, (save in the way of experiment, or for some especial object which may present itself, in the working of the course,) because from the vicinage of Victoria to the sea, and the attraction which its central mountain ranges will always have for the clouds of its locality, which may be supposed to be more than ordinarily surcharged with saline matter because of their newness, a moderate supply of salt will be received in combination with the rain of such clouds. Moreover, the atmosphere of a country, having more than six hundred miles of sea coast, will, at times, be impregnated with much saline matter from the sea spray, which it holds in combination, and which is impelled downwards to the earth along with falling rain.

It is not, therefore, that I undervalue salt, moderately used, as an arable fertilizer, but because I see, in the favorable position of South Victoria, a constant, and probably a sufficient, source of atmospherical supply (without either thought or cost), for the southern moiety of the colony, that I have refrained from prescribing its use in my arable course. As, however, the northern moiety of Victoria will, at all events, lack spray supply, and as its rain will probably be less saline, by reason of its greater rarefaction, consequent on increased altitude, I shall subjoin the following remarks of writers on the subject, which I consider judicious.

Mr. Hollinshead, who wrote on the importance of salt as a manure, and recommended sowing six bushels per acre on meadows after hay was got in, particularly in dry and hot summers, and upon limestone and sandy soils, observes, that the moisture which salt attracts and retains powerfully assists vegetation, and produces a crop greatly superior in quality to that obtained by the application of dung. For meadows he states it to have been found an advantageous practice to mix 16 bushels of salt with 20 loads of earth per acre, turning over the heap two or three times that the substances in it may be thoroughly incorporated, and spreading it on the surface either in summer or spring.

Mr. Rham, in his Dictionary of the Farm, thus writes:—"Sea salt has been extolled and decried at different times, owing probably to the different circumstances under which it has been tried. In a very small quantity sea salt may have a beneficial effect on the soil. Urine contains a great deal of it, and in the formation of composts sea water has been found to hasten the putrefaction of the animal and vegetable matters which they contained, probably by absorbing moisture, which is essential to putrefaction. Quick lime, slacked with sea water, and mixed with sand forms a mortar which attracts moisture so strongly that walls built with it are scarcely ever dry. This suggests a mode of supplying the soil with moisture, and may account for the effect of salt in particular cases."

Marl and nuctuous clays will have, ere long, such extensive application in

Anstralian husbandry, as correctors of the sterility and annoying propensities of loose sands, that I feel called upon to allude to that application. It is my opinion that if English Norfolk had been a county of average natural fertility, it would not have reached the agricultural distinction which it has; forasmuch, as is well known, the men of Norfolk were compelled by necessity to search for the elements of fertility elsewhere than in their surface soil; and were lucky in finding them beneath it, and thereby induced a marvellous result. The necessity for binding the loose sands of Australia, to prevent their annoying combination with hot winds, will impel a systematic search below the sands for the means of binding their surface; and both below and above them for irrigation water, to transform a desert into an oasis, which is, I apprehend, within the scope of human agency, though control of the winds is not.

There is too much puff and mystery about *artificial manures* to be satisfactory to me, and I regard them, at best, as mere stimulative nostrums, which, in some cases, under special circumstances, may produce a beneficial effect; but which, in the main, are not worth the money they cost, to say nothing of the disappointment and loss to which reliance upon their efficacy too often leads. A good husbandman, possessed of a fair quantum of live stock, need not be at all dependent on any quack preparation to ensure fertility.

I shall close the subject of manures by the statement, that, having advised the liming of the two clover leys in rotation for wheat, and given preferential shares in the homestead manure of the year to the potato field, and its companion field in green-crop rotation,—an arrangement which provides that a moiety of all the tillage land shall be every year either limed or manured,—I think it right, in consideration of the heavy cropping of the prescribed rotation, and to meet the drafts upon the land consequent on the repetition croppings of the cereals, and of the catch or extra cropping of the potato field and its companion field, to suggest a liberal application of guano or of poultry dung as a winter stimulant for the land in cabbage, turnip, and winter brassica cropping; and of a winter, as well as a spring, application of homestead manure to such parts of the two lastmentioned fields as do not get a guano application (if the circumstances of the cultivator will permit), it being but reasonable that double cropping shall have a double allowance of manure. I advise the occasional application of gypsum to the land intended to produce peas, beans, vetches, gramme, lentils, and other pulse; and of homestead manure to the land producing maize, buckwheat, sorghum, hemp, flax, millet, and the other cropping of that moiety of the field; and as often as it can be managed the application of charcoal or wood ashes as the top dressing of such of the cereals, barley, rice, oats, and rye as cannot have irrigation, with the view of keeping them cool and of regulating their supply of moisture, and if the supply of charcoal or wood ashes will sanction a consignment to the wheat fields also they will pay well for it; though, as wheat roots deeper than the other cereals, a top dressing of a compost of chalk mixed with night soil and

urine, applied in moist weather, to impart strengthening aliment to the young wheat, and induce it to shade the soil by its favorable habit of growth, might be even better than charcoal. If gypsum happens to be plentiful it may be very profitably applied as a top dressing to the clover fields, and if all that I have suggested can be managed it will be obvious that every crop of my course may have its appropriate application. I have known land in England over manured, and, as a consequence, deteriorated in value for sometime by the bad habit of producing straw in excess, and forgetting that grain also was wanted; but whatever may ail the eight tillage fields of Agraria Domain, I have, I think, in my eleven crops in eight years, with their cereal supplementings, provided effectually against their ever being endangered by the disease of muck-plethory, unless manure is wastefully applied to an extent sufficient to produce that disease. The three extra crops to which I have alluded are the catch clover, the winter brassicas, and the winter roots. I have avowedly aimed at exacting as much produce as land of first-class staple can be induced by high farming to yield, but I have also aimed at providing that land with a regular and well-timed succession of substantial and fitting aliment. The eight fields, being the mainstay of the stock department, have right to two-thirds of all the homestead manure; and the special culture department ought to have the remaining third in exchange for its equivalent in purchased manures. In regard to the special culture department I have to explain that cotton-plant refuse, duly prepared, will be a good manure restorative to cotton crops, and that, on true chemical principles, vine plant refuse will be a beneficial application in vineyards, and that such a plan is eligible in all special culture cropping in aid of other manures. The permanent pasturage will get some cattle droppings, and ought to have in addition periodical top dressings of compost, alternating between dunghill compost and compost in which lime, or some such fertilizer, is the efficacious ingredient. I am favorable to the application of salt on pasture land.

It will be advisable to have a sunken manure depôt, with a branch liquid manure tank attached, near the junction of the northern tramway, with its east and west branches, and a similar depôt and tank near the junction of the southern tramway, with its branches, in order that the carriages sent out for soiling produce may take with them solid manure from the homestead depôt to such of the branch depôts as they have to pass. Such a course may save much carriage bustle at busy times, and it will not, I apprehend, be difficult to protect the body of the carriages from pollution by some contrivance in the shape of a washable water-tight wrapper, liftable, with its contents, by a mechanical power, out of its carriage, and shot into the receptacle of the branch depôt, much in the way in which, when sailing up the English river Tyne, I saw Newcastle coal shot from the hanks of that river into the vessels intended to convey it out to sea.

In regard to the geological character of soils, I have to explain that I construed the words having reference to that subject, in the announcement for the Essay, as intending that the husbandry propounded should be in accordance with general geological principles, and not as intending that

the Essay should assume the province of a treatise on Victorian soils and their adaptation to particular crops. The comparatively small extent to which the geological survey of the colony has as yet reached, and the paucity of material as yet gatherable for due elucidation, suggested that construction, and confirmed me in it. I am, moreover, of opinion, that the effect of the onward move in agriculture, which, "practice with science" is impelling, will be to displace many of the trivial lines of demarcation hitherto subsisting between particular soils and particular crops; and that the terms "wheat land," "barley land," and "rye land," &c., &c., &c., hitherto used as indicative of special adaptation for particular crops, are already antiquated, and will soon become so obsolete as that it will not be necessary to import them into the husbandry phraseology of Australia. The farmers of Essex demonstrated long ago, that very strong soils would, if worked to a fine tilth, produce first-class barley: the farmers of Norfolk had before that shown that loose sandy soils, formerly deemed unfit for wheat culture, would, by the application of lime and a clover ley preparation, produce noble crops of first-class wheat; and in regard to rye I have often noticed, when tithing fields (in primitive English districts, where the old monkish admixture of wheat and rye continued to be sown on strong clays), such fine heads of rye, that I was led to the conclusion that if I ever grew rye for the purpose of distillation it should be on soils of medium staple, as more likely to be predisposing to potency than the rye grown on a sandy soil. Why, therefore, when nature is so ready to level her own barriers, and to open her vast domain to husbandmen who march under the banner of "practice with science," should agriculturists unnecessarily adhere to inconvenient distinctions, which nature has herself indicated willingness to abolish.

Soils are, as is well known, the debris of the rocks and earths which underlay them, and they, of course, partake largely of the properties of the underlying substances, chemically modified, however, by many years of atmospherical exposure and by other influences, and improved by vegetable accumulation. Volcanic agency has in many Victorian cases so fused, and, as I will term it, chemically cooked the soils of several favored localities as to have made them ready for use, with predisposition as well to fertility as to universality, in any cropping range; and I assume that grantees will take care to be well advised as to the quality of the land which they take up under the Land Act boon, and that first-class land only will be taken up so long as it is findable within the parlious of population unappropriated.

Agricultural chemistry teaches that productive soils combine largely *silica* (sand), *alumina* (clay), *humus* (or organic matter), and lime, and that they combine also, in lesser proportions, the oxides of iron and manganese, magnesia, potass, soda, phosphoric acid, sulphuric acid, and chlorine; and it is the triumph of modern science to be able, in many cases, by correcting the proportions in which they happen to have been in the first instance combined, to effect great improvements in the texture and productive power of a soil, but inasmuch as that is better which requires no mending than that which does require an operation to make it good, I incline to the opinion

that, until first-class land becomes scarce," colonists intending to pursue agriculture for a livelihood will do well, while they have abundant choice, to eschew land which wants any doctoring, and that, therefore, consideration of the geological and chemical character of the soils of Victoria may, without detriment to Victorian husbandry, await a call under the federal auspice of all the colonies for a simple and well defined nomenclature of all Australian soils as a common standard. In the meanwhile I apprehend the following classification will suffice to meet the purposes of this Essay :—

1. Clayey Soils. }
2. Sandy Soils. } Those in which the ingredient named predominates.
3. Clayey or Strong Loams. }
4. Sandy or Light Loams. } Those in which the clayey and the sandy ingredients combined are mixed also with humus, assigning the generic name to the ingredient which predominates in the loam.
5. Limestone formations.—Which were favorites with me in England, and are likely to be more so in Australia, because of the subsoil capacity of the best of them to retain moisture, and the regularity with which they give it out on surface excitement. They have, however, the drawback of being deficient in surface water springs.
6. Gravelly Loams.— Popularly called in England turnip and barley soils, and thought much more of in that humid climate than they are likely to be in the dry climates of Australia, save where irrigation is practicable.
7. Volcanic Soils.—Which I am glad to find abundant in Victoria, because of their great fertility.
8. Chalky Soils.—Which I am not sorry to learn are likely to be among the geological rarities of Victoria, because they would be here too arid for even sheep pasturage.
9. Peaty Soils.—For some purposes very desirable.
10. Alluvial Soils.—Generally the most fertile of any.
11. Mixed or Patchy Soils.—In some cases capable of great improvement when the price of labor will allow.
12. Sandy Districts.—Too loose for cultivation without adventitious aid.

NOTE.—The 3rd, the 5th, the 7th, and the 10th of the foregoing list may, as a general rule, be classed as first-class staples, as may also the 4th, if it happens to overlay either a marl or a genial clay.

Fencing is too important an object in husbandry to be passed over without notice even in a mere essay, though some years will elapse before living fencing can in Australia become general. The result of my own English experience (which has been extensive) is, that an admixture of prickly holly with the hawthorn, in the proportion of two hawthorns to one holly, makes the best of all growing fences. In regard to the hawthorn, great mischief has resulted from the inconsiderate assertions of early Australian writers, that it became here too delicately spiked to be of much use in fencing. I observed whilst in England the statement to that purport, which happened to have got into print, so often reiterated in subsequent

publications, that I concluded the fact was as stated, and that conclusion had a detrimental effect in my particular case; for when I was packing to come out, having an unoccupied space in a rough package, I should have filled it with berries from a favorite hawthorn seedling which caught my eye at the moment, remarkably prolific as a bearer, and more than usually rough and spiky in its habit of growth. I was, however, deterred by the recollection that as the hawthorn would be useless as a fencing material, I had better fill my space with something else, and I did so. It happened however that during my sojourn in Adelaide I observed in a neglected garden a considerable length of an old hawthorn fence, which I had the curiosity to examine, and I was agreeably surprised to find it as prickly and efficient as it would have been in England, as the scratched state of my hands after the examination amusingly testified. There are many willow-like varieties of the hawthorn in England, and most of the double-blossomed and the peculiar varieties, propagated by budding and grafting, are such, and I have no doubt but that the variety first grown in Australia happened to be of that character. The mischief in my case was however done, for I had the mortification afterwards to learn that my English successor, thinking my seedling too rough a tree for the position which I had assigned to it, had it cut down; and though I shall give to my English friends strict injunction, in gathering the berries both of the hawthorns and the hollies, which I am intending to import for Australian seed, from trees of rough and prickly habits of growth, I may be long before I produce another seedling hawthorn so eligible, as an experimental seed grower, as the one which I have so unwittingly lost. There is no effect without a cause, and it is my belief that nature will not be coy with inductive enquirers as to the causes of many of her effects, and that she will aid Australian husbandmen in their endeavors to establish and perpetuate peculiar properties called for in the adaptation of English hawthorns for Australian fencing. I noticed, when in England, that tall free growing quicksets (as seedling hawthorns are there called) were generally less prickly than those which were of slow growth and stunted; and I have observed in Victoria that quicksets are occasionally sufficiently prickly in their bottom and horizontally growing branches, whilst their vertical branches (which indicate greater rapidity in growth) are less prickly and efficacious than the horizontal ones of the same plant, from which I am inclined to infer that, as the bottom of a hawthorn fence will be its most important part, young plants should be retarded rather than quickened in growth until horizontal training shall have reached a given height. Gorse, blackthorn, crab-apple, and horn beam, which are in occasional use in British fencing, are so much inferior to the hawthorn and the holly that I never sanctioned their use in England, and I cannot therefore advise their introduction into Australian husbandry. There are several varieties of the holly which are unspiked, but these will of course be avoided in Australian introductions. The holly is a plant easily reared, and is possessed of great vitality and longevity. I raised thousands yearly for many successive years as easily and cheaply as I did hawthorns. The holly will be of quicker growth in Australia than it is in England, and it will therefore on that account here escape the only objection which I

ever heard urged against its general adoption in English fencing. The prickly accacia, the prickly cactus, the Cape broom, and some other plants, which I have seen applied to fencing purposes, both in South Australia and in Victoria, are nothing to be compared to the holly and the hawthorn for substantial fencing, and I shall therefore enjoin a plentiful introduction of holly and hawthorn seed berries by every opportunity, until Australia shall produce its own supply of seed.

English farmers of strong land will perhaps think that I have overlooked necessity for periodical summer *fallowing*, but such is not the case; for that subject has had much of my thought, and I have arrived at the conclusion that in Victorian husbandry fallowing need not be periodical, as in England. The climate of England is so humid, and the soil is generally so saturated, that it is only in midsummer weather that strong soils are there dry enough to be effectually worked and cleaned. Hence arose the English practice of summer fallowing, which afterwards gave rise to the custom which regulated the right of outgoing tenants in the wheat crop of the harvest following the expiry of their tenancies, and which required as a condition that the first ploughing of the fallowing process should precede midsummer day. The introduction of fallowing formed an era in English husbandry, and was productive of good; but intelligent farmers at the commencement of the present century began to question the necessity for sacrificing triennially an entire year's cropping, merely to clean and rest their land, and the question ended in the ascertainment that the supposed necessity for rest was a fallacy, and that feeding the land with manure was of greater avail than a fallow rest. By degrees midsummer fallowing gave way to prompt spring management, and the practice is now so obsolete that the apologists for an occasional full fallow only plead climate necessity for a pulverize which is rarely to be had in England save at midsummer. Now, it luckily happens that the genial climate of Victoria affords such ample opportunities for thorough pulverization and working between crop and crop, and the soil is so often, even in midwinter, so dry and workable, that, save in the thorough subsoiling operation necessary on bringing land for the first time under cultivation, I have come to the conclusion that no cropping need be sacrificed to secure in Victoria the purpose of an English fallow, at least twice, during my course, as I will show. That course starts with wheat, and between wheat harvest and the first potato setting and the first green crop planting, several months intervene, and if the autumn should happen to be wet, the probability is that the spring would be dry. Four years afterwards wheat again recurs in rotation, and affords a second and a similar opportunity for a thorough working and cleaning; and, in addition to both opportunities, advantage may be taken of the interval between the oat and rye harvest of the seventh year and the pulse seedness of the eighth, to do anything further which the state of the land may require. Those considerations led me to reject fallowing, in the English signification of the term, in my course, as a periodical interloper in cropping season.

In regard to *draining* also, Victoria is, happily, better circumstanced

than England, inasmuch as evaporation goes on so steadily and rapidly that the soil is never saturated for any great length of time, except where impediment impounds water up, in consequence of which systematic underdraining is not the essential preliminary which it is in England to first-class Victorian husbandry. A few judiciously placed surface drains, with subterranean levels to carry off flood waters, aided by thorough subsoiling leavenings of the under soil, induced by the admission of atmospherical influences, under the powerful agency of machinery impelled by steam, will be a much cheaper and a more efficacious measure of Australian fertility than British draining operations, masterly as they have become. The draining skill of Victoria will be, in great measure, confined in scope to the drainage of bogs and swamps, and as an auxiliary subservient in irrigation. Viewed properly that circumstance is an inestimable advantage to the landowner, because it relieves him from an immense outlay at the commencement of his operations, when the conservation of his capital is to him a greater object than at any subsequent period of his career.

The political aspect of Australia is as favorable to its husbandry as is its climate, for though Australia shares with the mother country in the blessings of British law and British liberty, it is happily without the incubus which participation in the national debt and in the taxation which has always, in England, been heaviest on the agriculturist and his land, would occasion. Neither tithes nor tithe composition, nor land tax, nor income tax, nor rates for the repair of the church, nor highway rates, nor statute duty, nor county rates, nor poor rates, nor any of the many such like voracious demands on British husbandry, attach upon that of Australia, save in a few exceptional cases; and though I have been an Australian three years, the only tax outgoing which I have been called upon to pay, has been an annual rate of a shilling in the pound on my rental amount, which covered all purposes for which I was liable; and if, as far as the Colony of Victoria is concerned, its too many legislative cooks had not spoiled its recently passed Land Act, it might have been a model for that of other colonies, instead of being the unsatisfactory measure which it now is, demanding much amendment before it can be considered equal to its occasion.

The introduction of a cheap and simple mode of conveyancing and dealing in matters regulating land ownership without necessity for the intervention of professional men, would be an Australian blessing. It happens that the two English Land Agency Offices in which I spent successively thirty-six years of my professional life, were both of them remnants of an old English practice which combined law and land agency, (for up to the commencement of the present century, nearly all the larger landed estates of England were under the agency management of attorneys); so that having had more than an ordinary share of legal and conveyancing experience, I am competent to give an opinion on the practicability of such a measure. There are very serious faults in the South Australian scheme of Mr. Torrens which overbalance his salutary provisions. The stability of a rock, rather than the impulsive movements of a rudder, should have been at the bottom of his scheme, and his

pervading object from first to last. His intentions were better than his legal skill, but his design of adapting ship conveyancing, applicable only to that which is proverbially the most veering of all property, to land, was so erroneous and whimsical in conception that many of his pet provisions will have to be thrown overboard before his measure can be pronounced safe; though some of his aims were good, and may, with the valuable aid afforded by the recent labors of the Imperial Parliament in that direction, enable colonial legislators to mature a measure by which officials entrusted with its working, shall, for a moderate fee, give effect to the intentions of vendors and purchasers, mortgagors and mortgagees, lessors and lessees, by simple, but valid documents, prepared and perfected at a single interview, if all necessary parties and previous documentary links in the title are forthcoming, so that professional cost need attach only on special occasion.

I happen to have had too much troublesome experience in English commonage matters, to be sanguine as to the result of any introduction of that system into Australian husbandry; for, in addition to the monition of the spectrums visible to my mental eye whenever I rode across an English common, in the semblance of horse and cattle stealing facilities, the costly working of an annoying impounding system, the instinctive cunning of the stronger and best tended herds to monopolise the best feeding places, the absence of conscience in too many of the parties exercising commonage right, and the danger to which animals coming into contact with contaminating disease were exposed, I see and hear on Australian commons that dire object the pleuro-pneumonia croakingly forbidding prudent men to avail themselves of the very trifling benefits promised by a system unworthy of adoption even in a golden age, but fraught with peril in the iron one which is now current.

As a sound policy in the landed economy of a colony, is the best base on which its husbandry can rest, I am inclined to advise, in the case of Victoria, the restoration of the provision in its Land Act, which carried deferred payments over a longer period than was in the sequel adopted. Many cases suggest themselves to a land agent of experience, in which the fourfold arrangement would have been a great boon; and, as the Government retained the fee of the land until it should be actually paid for, it did appear to me that the boon might have been granted with safety to the community. The disposal of contention in claim by two parties applying for the same section, by lot, which the Act in the first instance proposed, was much more consonant with English law than the system of limited auction, which was intruded in its stead, and I much marvelled that during the discussion on the clause no advocate for lot arrangement reminded the public that the auction system was not of English constitutional growth, as was supposed, but was a mere modern outlandish graft, barely a century old, which the East India Company had introduced into English practice for the disposal of their merchandises; whilst, on the contrary, lot was accordant with English law, a thousand years before that introduction. Moreover, as the spirit of the Act evidently intended that all claimants should have equal chance, it was inconsistent to lengthen unconscionably the sword of a wealthy antagonist, where the Act intended contending parties to have that equal chance. The penal clauses of the Act were both badly conceived and badly expressed. No right-minded man will object to being

bound to a given expenditure within a given period in the erection of a homestead on his section, and in its cultivation, by himself, or his tenants, or his servants; but to compel him to reside on it in person was interfering as much with his personal liberty, as the restriction upon his cultivating the leasehold part of his domain did, in regard to his legal right to pursue the course best adapted to accelerate the development of the productive capabilities of that land which was shortly to be his own in perpetuity. If the colonial purse had been bound to compensate in the event of failure, I should have seen a motive for the prohibition, but, as the Act expressly repudiated compensation, I could never comprehend the why and the wherefore of this prohibitory regulation. The time has, in my opinion, arrived for the application of well considered leasing powers to any part of the unalienated land of the Colony of Victoria, and especially to what are generally called squatters' runs. A geodetic square of 25,000 acres, appears to me to be, in the present stage of the colony, a convenient size for a maximum run, and an eighth of such a square, a convenient minimum size. The term of years and tenancy terms, will of course be matters of legislative and executive arrangement, and though it might be improvident to lock up for a long term runs of greater extent than a geodetic square each, there is no reason why the pastoral interest shall be unnecessarily crippled, or why, so long as land is abundant, squatters owning large flocks shall be confined to one run. The great matter will be the exaction of a fair rental revenue up to the time the land is either wanted for higher occupation purpose or to pass into private ownership. As Victoria is fortunately to have only the two tenures of freehold and leasehold, it follows, that the distinct scope of each should be clearly understood, and that leasehold rights should be well-defined at their creation. The Colony possesses so many husbandry advantages that when its Land Act shall have been amended, and the importation of British labor shall have been considerably regulated, it cannot fail of becoming popular among British husbandmen and British laborers of the rural districts, when a speedy development of its agricultural capabilities will ensue.

Educational institutions like that of Cirencester in England, and agricultural professorships like those in the English universities of Durham, &c., and peradventure also some of the modern arrangements of European continental establishments for the systematic development of landed economy, ought to be among early Australian provisions for the purpose of training youth for the dignified exercise of the most venerable of all professions, for such is in reality that of husbandry, inasmuch as no fraternity can produce a charter which can vie in origin with that primal one of the earth, granted to Adam, the first husbandman, in that ever memorable fiat of Deity: "Be fruitful, and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. Behold I have given you every herb bearing seed, which is upon the face of the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat." And though the agricultural profession has had the ill luck to be thought less exaltedly of in England than it was in ancient Rome, it has nevertheless added to the plume of British greatness one of its best developed feathers; and I shall take the

liberty of stating, that I have yet to find a profession either more deserving of encouragement, intrinsically, on its own useful account, or more learnedly interwoven with general science, than that of first-class husbandry; in which zoology, botany, mineralogy, chemistry, geology, physics, and the sciences which regulate heat, light, electricity, water, air, and a host of atmosphericals; architectural and mechanical, structural applications, and the principles which govern the construction of machinery, implements, and utensils; anatomy, physiology, cattle medicine, and entomology; astronomy, in its regulation of the seasons; and geography, in its statistical details, as to the habitats of animals and plants, and the localities of fertilizing substances; and many other branches of exalted science, and applications of superior manual skill, are mere contributory constituents: and yet, I am not aware that either professors or lecturers in any branch of either landed or agricultural economy pertain to any Australian collegiate establishment at present in existence. This is not as it ought to be; and I must remind Australians, that however important dead languages and abstruse investigations may be on some occasions and for some purposes, and that, however assuming political and statistical matters may be in their demands on the public purse, the due development of the agricultural resources of their new country is paramount in importance to any of them; and that at the present time Australia has greater need of foundations which shall produce intelligent practitioners in a path of usefulness, on which the footsteps of Jethro Tull, Arthur Young, William Marshall, and Sir John Sinclair, Bakewell, the brothers Colling, Tomkins, Culley, Ellman, and many others, have left an impress of dignity, than it has, as yet, for those which are to produce Australian Adam Smiths and Jeremy Bentham.

So far as Victoria is concerned, I hail with satisfaction the recent establishment of the Acclimatization Society of Melbourne, which may be made a powerful auxiliary, not only in the domestication and increase of useful zoologicals, and especially of quadruped ruminants from every region of the earth, but also of placing, at moderate cost, within the reach of intelligent breeders the blood of any animal wanted to impart greater perfection to the flocks, herds, studs, and collections of its kind, pre-existing here; thereby adding to the excellence of our stock and increasing the pastoral wealth of the colony. And I also hail with satisfaction, though with a degree of expectation somewhat less sanguine than in the other case, its recently established Horticultural Society, because I fear that the useful will be made too subservient to the pleasurable, and that flowery and showy trivialities may receive greater attention in their development than the acclimature of useful vegetable introductions, and the formation of varieties specially adapted for Australian culture, which ought to be its chief care.

Victoria may fairly indulge pride in the contemplation of the Botanic Garden at Melbourne, which has already yielded valuable scientific fruit and is full of hudding promise. I cannot conceive a finer field for intellectual enterprise than that which Dr. Mueller is so profitably cultivating; he can with truth exclaim, in the language of Holy Writ, "The harvest truly is great, but the labourers are few." Notwithstanding the number of plants to which I have called attention as worthy of Australian culture, I think it within the pale of probability that Australia possesses indigenous types of the greater part of

them, and that the soil and climate of Victoria will enable scientific cultivators to expand, in the course of years, those types into varieties, and, peradventure, species, worthy of European attention.

The astronomical and atmospherical establishments of Victoria are conducted on true inductive principles, and are already producing valuable fruit. To them I would confide the series of climature ascertainment in various localities, required to decide their mean climate heat, and to point to where the intelligent husbandman may delve to the best advantage in the culture of the more special of his products. A well arranged floral kalendar, which shall adapt the seedness and harvest periods of Victorian cropping in a dozen standard localities, to those of London, Edinburgh, Dublin, Paris, Rome, &c., &c., &c., and the various regions in which introduced vegetables have had their best cultural development, would be worthy of the joint labor of Dr. Mueller and Professor Neumayer, and ought to have immediate attention.

The establishment of agricultural libraries in every county town of a colony is an imperative duty in a new region, in which two-thirds of its immigrant population betake themselves to the exercise of a calling in which they have had no previous instruction; but as most of them (thanks to the educational philanthropy of the nineteenth century) can read, there is that mode by which adults who have to earn their bread before they eat it may glean a few heads of agricultural experience for their guidance. Whatever induces thought is sure to be productive of good, in any field of labor; and as the age of miracles and miraculous intervention has passed away, the best mode of arriving at knowledge in the ordinary course of things must be resorted to.

Written law is not more essential to the lawyer than is written agriculture to the agriculturist; it luckily happens, however, that the geological literature of England is peculiarly rich and valuable, inasmuch as the inductive observations of our sagacious British forefathers have been so well recorded, and subsequently commented upon by Young, Marshall, and Sinclair, and their worthy conditors of a past age, that we inherit in our mother tongue, which appears to be the predestined living language of the world, material for a code of Australian agriculture, as comprehensive in its scope as the importance of the region demands. Recourse may be had to the writers of France, Italy, Spain, Germany, and some other European countries, and to the writers also of America, as to matters out of the pale of British husbandry; and great benefit might result from judiciously compiled treatises on the various products which I have proposed to include in Australian husbandry, and such other products as may be added to my list. And when it is considered that the English language is already that of Australasia, and will be soon the general language also of India and of America, and the African settlements also, and that all the places mentioned are either already or soon will be embarked in agricultural pursuits, a vast field is opened for the periodical interchange of agricultural information, and the circulation of an agricultural journal worthy of Australasia, and of a series of practical treatises on the more important products which all will be, more or less, engaged in cultivating.

It has frequently occurred to me whilst composing this essay, which may, (when expanded into a practical treatise of six times its present bulk), probably

entitle me to the fathership of systematic Australian husbandry (inasmuch as it proponnds an entire system whilst all the Austral and Anglo-Austral agricultural publications which have come under my notice, have been limited in their scope to one particular object, as for instance, the vine and its culture, or some other such special product); under what different and discouraging circumstances Sir Anthony Fitzherbert, an English judge, produced, in the despotic reign of Henry VIII., the father book on British husbandry, which he published in the year 1534, and probably wrote, amid the bleak and then cheerless scenery of Derbyshire, as the manual of a nation which then fell short in productive capacity of that of his own bleak shire 300 years after his book was written; what an insignificant notion he must have had of the dignity of his subject in comparison with that which greeted my eye in the course of an actual survey, extending over time amounting in the aggregate to three years, which I took of the agriculture of the fifty-two counties of England and Wales, after the Royal Agricultural Society of England had begun its noble march, under the banner of "practice with science," which is so wonderfully expanding the ramifications of Sir Anthony's little oak.

Sir Anthony's conception, when he put his acorn into British ground, was probably bounded in its northern scope by the River Tweed, but it could not, under any circumstances, have carried him in vision beyond the ever venerated shores of Britain and Ireland, and his products would be limited to the few starvelings of the vegetable world then known to him; whilst my little pet, "the Victorian seedling," may possibly, three hundred years hence, overshadow a region almost equal in size to Europe, and greatly exceeding even that highly favored quarter, as a whole, in climate advantages, producing, in one district or another, in the open air, highly developed varieties of "every herb bearing seed which is upon the face of the earth, and every tree in which is the fruit of a tree yielding seed," and may, though the last discovered region of the earth, probably, owing to its free institutions and the energy of its sons, have enabled Australia to be, in consequence of its having surpassed Europe in the extent of its cultivated flora, the first of the five great divisions of the earth, entitled to claim Adam's husbandry charter as an heraldic trophy.

In developing their Australian germ, the expatriate sons of "garden cultured England," have ample scope for their inductive energies in the subjugation of the devastating vagaries of unregulated heat, and the taming of sirocco brickfielders; the bringing to the surface subterranean water, and conserving and distributing the supply already there; the reduction of insect rapacity and annoyance, and estopping their myriadfold ratio of progression by the introduction of counteracting zoological inimicals; and the importation of such animal and vegetable subjects of nature as will best subserve in securing for Australia a greater range in the agricultural economy of his dominion than has fallen to the share of any one of his four elder compeers in the government of the earth, which have all been committed to their charge as a responsible trust, by the mother country, and as almost the only condition annexed to the boon of self-government and the noble heritage of British law, language, and liberty, which is now their irrevocable right for ever.

It is, however, cheering to know that much less thought, skill, and cost, will effect miraculous changes for the better both in regard to hot winds and to

water supply, than their British forefathers were called upon to bestow in their climate contests with ruthless frost, and in relieving their land from the pernicious consequence of excess in that surface water which is here coveted. Numberless and incessant were the well-directed efforts of English farmers, before the dairying of Cheshire, Gloucestershire, Wiltshire, Somersetshire, and Devonshire; the hop-culture of Worcestershire, Kent, Sussex, and Surrey; the meadow-floating of Herefordshire, Wiltshire, Gloucestershire, and Dorsetshire; the matchless system of drainage and management which has given to the Fen districts of Lincolnshire, Cambridgeshire, and "the land of the levels" their only passport to value, as good *terra firma*; the warping operations of Yorkshire and Lincolnshire; the masterly tillage of Norfolk, Suffolk, Essex, Lincolnshire, Yorkshire, and Northumberland; the orcharding of Herefordshire, Worcestershire, Kent, Somersetshire, and Devonshire; and many other prime features of English husbandry, which are unfindable elsewhere, drew forth from admiring Europe his plaudit, that England, despite its climate disadvantages, was the agricultural paradise of the earth.

In conclusion, I shall, as the exponent of a course of cropping which brings rice into fellowship as to culture with its kindred cereals, and rye into friendly rotation with pulse; which seeks to exact extra yield from cereal vitality, and proposes to subject even fugitive catch cropping to systematic regularity; which proposes to expand the pre-existent range of zoological domestication into an absorbing system sufficiently capacious to comprise the most useful and profitable of the "living things" of that vast range of dominion which was committed to Adam's care; which projects the union of agriculture with horticulture for the production of a special branch of warm climate culture, worthy of Australian growth, and to become, in after times, the pride of its husbandry; unfurl in Victoria the banner of "practice with science," and, waving it, exclaim, "Advance Australia Felix," and win, by well-directed irrigation effort, the vanship in Australian husbandry, which may thereby become, in perpetuity, thine.

Floreat Victoria! saith "AGRARIAN," on bidding his subject, for the present, adieu.—1st October, 1860.

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